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# Railway Mechanical Engineer

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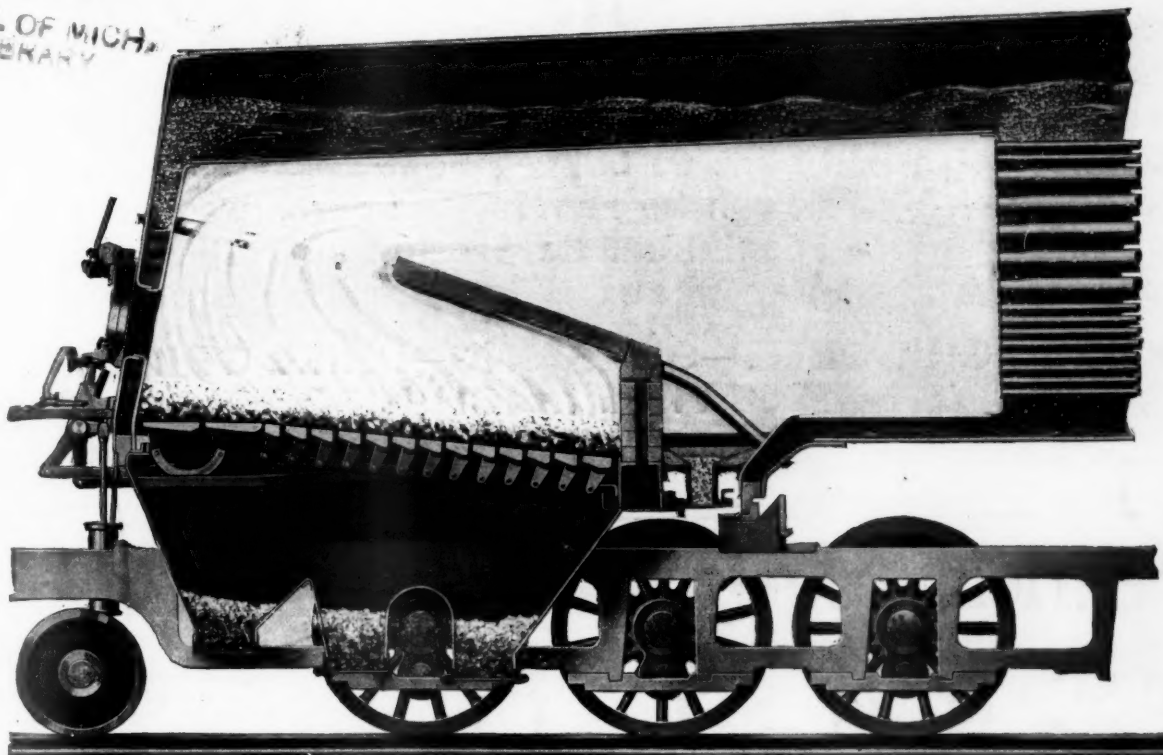
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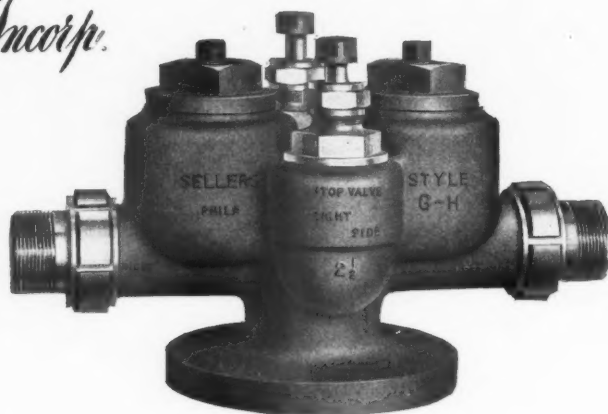
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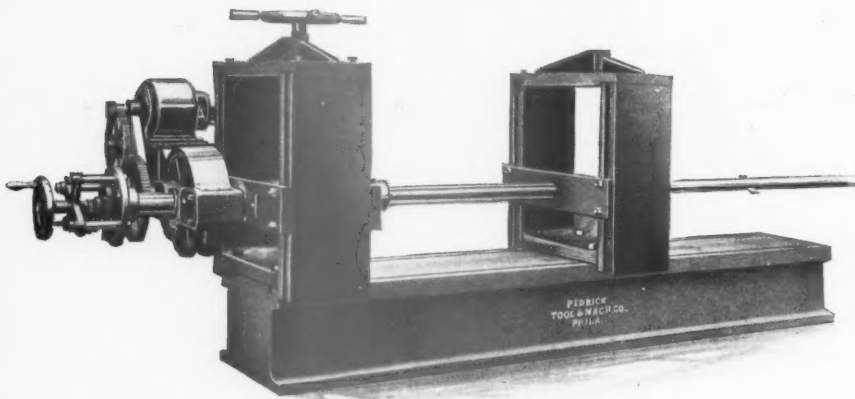
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# Railway Mechanical Engineer

Volume 91

April, 1917

No. 4

## Locomotive Rod Job Competition

An announcement was made on page 117 of our March issue of a competition on locomotive rod work. This competition will close May 1, and those who have not already done so should start their contribution at once so that they will be finished in good time. Few roads follow the same methods and practices in doing this work. Some do it better and cheaper than others. It is the purpose of the competition to bring together in a concise form, the best practices. Our readers can then choose those which best suit their conditions. In order that the best results be obtained from the competition, all of our readers who feel that they have a particularly good and satisfactory method of doing this work should contribute. Our purpose is to spread broadcast, ideas that will be of assistance to all railroads. These ideas must come from the men on the firing line, so do not hesitate to send in what you have if you think it will be of assistance to others. The three articles, which from the standpoint of practical suggestions are considered to be the best, will be awarded prizes of \$20 each. The contributions must reach our office in the Woolworth Building, New York, on or before May 1, 1917.

## Collision Shocks on Steel Equipment

On another page in this issue is a photograph and brief description of a rear end collision which recently occurred on the Pennsylvania Railroad, in which one steel sleeping car was completely telescoped by another. The force of the collision was such that it is remarkable that greater damage was not done to the passenger train equipment. The manner in which the two cars were telescoped, however, raises the question whether or not the use of an anti-telescoping device, which would maintain the underframes in the same horizontal plane, should not be carefully considered. Of course it is impossible to say just what might have taken place had the two cars involved been so equipped; but it is evident that the two underframes were first thrown out of line before the damage was done. On practically all of the more recently built steel passenger equipment in this country, vestibule end posts of heavy sections are provided and the probabilities of telescoping equipment thus constructed are very small, even without an anti-telescoping device. However, where a question of safety is involved and where the conditions to be met when the emergency arises are so uncertain, the use of the additional safeguard is desirable.

## Application of Safety Appliances

Even though a request has been made by the railroads for a further extension of time in which to equip freight cars with proper safety appliances, the roads will be open to the most severe criticism if they leave any stone unturned to finish this work at the earliest possible time. The Interstate Commerce Commission held a hearing on March 1, at which several railroad men testified that with the great demand for cars, it would be impossible to com-

pletely equip them with standard safety appliances by July 1, 1917, the date set by law, without greatly inconveniencing shippers. On January 1 there were 296,033 cars unequipped. In the six months prior to that time only 160,000 were equipped and at that rate it was claimed it would take another year to equip all the cars properly. The railroads were strongly opposed in their request for further time by the brotherhoods; H. W. Belnap, chief of the Division of Safety, thought that a large part of the unequipped cars could be equipped if the roads would permit the work to be done by foreign lines.

The commission has had the matter under consideration for the entire month and up to the time of our going to press had not acted on it. Although there is little question but what additional time is needed and should be granted in the interests of public welfare, because of the peculiar conditions which exist at this time, the railroads, if an extension is granted, must not let up for a moment the work of carrying this work to completion; indeed they must go forward with still greater energy and must co-operate with one another more effectively in the actual performance of the work. The M. C. B. Association has advanced to June 1, 1917, the date on which cars not equipped with safety appliances will be received in interchange from home roads. The big problem, however, is to get the cars equipped, so that they may be retained in revenue service after July 1.

## Bills of Material

An excellent practice followed by the mechanical department of a Western road is that of attaching a bill of material to every order of reconstruction to be made in its equipment. The bill is made out by the designer as he lays out the work to be done. The size and number of the different parts required in the work is given to the minutest detail. Being the one most familiar with all the changes and additions to be made, he is less liable to omit a necessary part than the man on the job who must study a blueprint to find out what is needed. Further, it enables the foreman in charge of the work to order his material promptly on receipt of the plans for the work. As the material is received it is checked off the original bill and the work is not begun until everything is at hand ready for application. This eliminates delays and insures that the work will be done without interruption.

## An Additional Incentive for Fuel Economy

American railroads have given much attention to fuel economy in recent years and incidentally efforts in this direction have been intensified during the past two or three years on many roads because of the necessity for increasing the capacity of the locomotive to the uttermost in the effort to reduce operating expenses by increasing the trainloading. Another factor is entering into the problem which promises to inspire still greater efforts towards fuel economy, and that is the greatly increased cost of fuel. Many roads will find it necessary to pay almost

double the prices per ton which they paid during 1916. President Rea, of the Pennsylvania Railroad, in his testimony before the Interstate Commerce Commission for an advance in freight rates, stated that seven of the eastern roads, including the Pennsylvania; New York Central; Baltimore & Ohio; Norfolk & Western; Chesapeake & Ohio; Virginian and Western Maryland, paid an average price of \$1.21 per ton for fuel purchased during 1916. It is quite probable that for the coming year they will have to pay an average increase of at least \$1 per ton. President Underwood, of the Erie, stated that the surplus of \$4,500,000 for last year would be entirely absorbed this year by the increase in coal prices alone. President Rea estimated the increase in expenses for 1917 as compared with 1916 for the Pennsylvania system as follows Taxes, \$500,000; fuel, \$10,200,000; increased price of materials, \$11,000,000; wages, Adamson law, \$13,500,000; wages other employees, \$7,400,000; total, \$42,600,000. Because of these greatly increased expenditures to which all of the railroads are being subjected it will be necessary to practice severe economies and to do everything possible toward improving the efficiency of operation. Of the items mentioned above, fuel is the only one on which any great saving can be made, the other items being very largely fixed except as they may be affected by increasing the trainload and securing better carloading; thus utilizing the plant and equipment to better advantage.

#### Efficiency of Motive Power

Approximately one-tenth of the money expended in the operation of American railroads is required for fuel for locomotives. Next to wages it is the largest single item of operating expense. That the extent of the saving which may be effected through the reduction of fuel consumption by even a small percentage is generally appreciated, is evident from the careful supervision which the handling of the fuel supply receives, from the mines to the locomotive firebox. The benefits of such supervision cannot be overestimated, but it cannot go beyond the firedoor. Once in the firebox, the amount of work which is to be secured from the fuel consumed is largely in the hands of the designer.

Much has been done to improve the efficiency of the locomotive by the addition of fuel saving devices, but more attention should be given to the proportioning of the locomotive itself, in order that the highest possible efficiency may be obtained at every step in the process of converting the heating value of the fuel into drawbar horsepower. One of the features most carefully investigated in a proposed stationary power plant installation is the cost in fuel per kilowatt hour of energy delivered. There are few mechanical department officers responsible for new power house installations who will not know the number of pounds of coal required to produce a kilowatt hour in even a small plant. With hundreds of locomotives in operation, each having a capacity ranging from 500 to 2,000 hp., few mechanical department officers can say even approximately how much work at the drawbar they are getting from the coal consumed.

It is natural that in buying new locomotives, the mechanical department officers should give the greatest attention to mechanical details affecting the future cost of maintenance, this being a problem most directly affecting the work of the department. But the possibility of improving locomotive performance and reducing the cost of conducting transportation by increasing the efficiency of future locomotives should not be overlooked. More attention should be given to the study of the future requirements for motive power in order that time may be given to develop and refine the design best adapted to meet those requirements before the power is actually needed. After a decision has once been made to purchase new locomotives, the time at the disposal of the designer usually permits of nothing more than the assembling of a number of details, which will do but little more than to

meet the requirements as to maximum engine tractive effort.

What may be accomplished by careful engineering in the development of a locomotive design is clearly shown in the performance of the Pennsylvania Atlantic type, Class E6s, on the testing plant at Altoona, Pa., an account of which will be found elsewhere in this issue.

No doubt the work of the test plant was invaluable in the development of these engines, and such facilities are not available to other roads. If, however, the fundamental knowledge as to correct locomotive proportions which is available at the present time, were used in the design of every locomotive built, it is safe to assume that the average efficiency of our motive power would be considerably higher.

#### Improving Roundhouse Facilities

The roundhouse is closer to the actual work of conducting transportation than any other part of the railroad under the supervision of the mechanical department and its importance is generally realized, yet there is a strange indisposition manifested by some officers of railroads towards keeping roundhouses in efficient condition. New roundhouses are, of course, built from time to time, and in their construction and equipment the best practices are usually followed, but the average roundhouse is given little consideration until some difficulty develops which makes it imperative to provide improvements.

The fact that the need of good facilities at roundhouses is given so little attention is largely the fault of the roundhouse foreman. In the operation of an engine terminal there are certain inconveniences which cannot be eliminated. The foreman realizes the fact and comes to look upon the unnecessary evils in the same light that he regards the inherent difficulties in his work. The roundhouse foreman always has troubles too numerous to mention and he does not want to complain for fear that he will be considered a grumbler, so if he mentions his troubles to his superior officer he fails to register an emphatic protest against the conditions which he knows could be remedied. As a result, when appropriations are made, grade crossings which have given trouble are eliminated and a new station is built for the comfort of the citizens of Jonesburg, but the needs of the roundhouse are forgotten.

The difficulty of foreseeing what movements will have to be taken care of when a terminal is built often makes it advisable to change the arrangement of tracks after the weak points have been discovered, but there are many terminals operating to-day with insufficient track space, which necessitates extra movements and is a prolific source of trouble. At all but the smallest terminals there should be more than one track for locomotives entering the roundhouse and leaving the roundhouse. Too often but one track is provided for the movement in each direction and a great deal of time is wasted in switching movements. Since the federal inspection of locomotives has been in effect it has become specially important to determine the condition of the incoming locomotives as quickly as possible and a pit over which the locomotive must pass before being coaled is usually found to be the most satisfactory arrangement. Nevertheless at many roundhouses the locomotives are still inspected on the roundhouse pits. There is hardly an engine terminal where a close study would not disclose opportunities for doing work more economically.

On a large western road it recently became necessary to tear down an old engine house and a modern terminal was provided. The saving in wages effected by the new plant was at the rate of \$40,000 a year. There are many roundhouses now in operation which are quite as bad as the one which was torn down in this instance. It is not always possible to effect such marked economies, but in many cases changes can be made which will materially reduce the cost of operation. The roundhouse should not be regarded as a place to dump machine tools which cannot be used elsewhere, nor should the plant in general be neglected until it becomes

necessary to replace it. Roundhouses should have the best facilities for doing work which can be provided. The foreman who realizes the shortcomings of his plant and does not take energetic measures to correct them, fails in the duty which he owes to his superior officers and to the road.

#### The Valuation of Rolling Stock

In the valuation of cars and locomotives the Interstate Commerce Commission is using a method of determining the cost of reproduction less depreciation which may work a grave injustice to the railroads. The continual development of more efficient equipment has made it profitable in all branches of industry to retire old equipment before it has been completely worn out and to replace it with a more efficient type. So, as the weight and efficiency of locomotives and cars have increased, it has proved economical to discard old equipment after a comparatively short time. Practically all locomotives and cars are retired, not because they are actually worn out, but because of obsolescence; they will still run almost as well as ever, but nevertheless have become inadequate for the service, which is constantly growing more exacting. This is a *functional*, not a *structural* depreciation, and is not due to the depreciation of the individual parts of the equipment. The confusion of *functional* with *structural* depreciation has given rise to a common misconception which has had an influence on valuation practice and has resulted in errors in the methods employed.

The question of the amount of depreciation which actually exists in a plant is one upon which there is still great difference of opinion. Depreciation undoubtedly exists in the separate parts of the equipment and can be determined for each individual part. In setting the cost of reproduction of equipment less depreciation, the depreciation of the individual parts doubtless should be used; but in determining the amount which should be set aside from the net income for the replacement of obsolete equipment it is necessary to consider the functional, not the structural, depreciation.

The method used by the Interstate Commerce Commission in determining the amount of depreciation existing in locomotives and cars is based on the *functional* depreciation rate; the value of the equipment is found by ascertaining the probable life, based upon past experience, the result being modified according to the actual condition of the parts as ascertained by inspection. The whole method is based on the assumption that all the locomotives now in use in the United States will be retired at the average age at which locomotives have been retired in the past. This is a dangerous premise, as the working of obsolescence in the past affords no certain standard for determining how it will work in the future.

The fact is, there is very little physical deterioration in a locomotive or car until the end of its functional life is nearly reached. Its physical condition could be kept nearly unimpaired for an indefinite period, but as the time when it is to be retired approaches the amount spent for maintenance is reduced, and the equipment deteriorates more rapidly. A detailed examination of the effect of the depreciation of the parts on the value of the whole will make this clear. If we take the driving wheel tires as an example of the cycle through which all the parts of the locomotive pass, we will find that the curve of their value, starting at 100 per cent, decreases gradually but never reaches a point below the scrap value of the tires, which we might set at about 20 per cent of the original cost. If the tires are removed at the end of eight years and new ones substituted those parts are brought back to 100 per cent condition. If we consider another part, as, for instance, the boiler shell, we find its life to be, let us say, 25 years. Its value, then, decreases gradually from the time the locomotive is built until it becomes 25 years of age, when the value of the boiler becomes merely its salvage value or about 20 per cent of the

original cost. The tires will have been renewed one year prior to the time that the boiler is retired, and their value will be 90 per cent of the original value. It will be seen from this that the physical value of a locomotive does not decrease steadily until the end of the term of years after which the longest lived part must be renewed. Some parts do not depreciate at all and their value, even when the locomotive is retired, is still 100 per cent of the first cost. The effect of the difference in the life of the composite parts is to keep the physical value of the whole far above the scrap value until the end of the service life is reached.

Mr. Prouty has indicated that the cost of reproduction less depreciation will not be used as a basis for fixing rates. Nevertheless, it is to be hoped that the commission will see fit to modify the straight line depreciation which it has applied to locomotives and cars.

In a report to the St. Louis Public Utilities Commission made in 1912 James E. Allison said:

"To claim that investors have been reimbursed for depreciation by excess profits in the past is to deprive them of a part of their legitimate past profits to create a needless depreciation fund and is equivalent to regulating profits in the past by enactments today. This is an *ex post facto* proceeding and is inadmissible as a matter of law or as a matter of justice." The railroads paid 100 per cent for their properties, although the normal theoretical value may be less. They have not been allowed to earn the depreciation, and if the property is to be allowed to earn only on the remainder of its value the difference between the first cost and the depreciated value has been confiscated. If old locomotives had been kept in service, rates would be high and valuation would be low; the public would pay for inefficiency. The valuation of the present property, depreciated at the functional rate, if applied in rate making, will penalize the railroads for being progressive and efficient. Any statute which would make for inefficiency in the future would doubtless be condemned. The proposal to penalize the railroads by an *ex post facto* regulation for their efficiency in the past lacks even a semblance of justice.

#### NEW BOOKS

*Fuel Association Proceedings.* Edited by J. G. Crawford, secretary, Chicago, Burlington & Quincy, Chicago, Ill. 355 pages. Illustrated. 6 in. by 9 in. Bound in paper and leather. Published by the association. Price, paper bound, 50 cents; leather bound, \$1.

This is the official proceeding of the eighth annual convention of the International Railway Fuel Association, which was held at the Hotel Sherman, Chicago, Ill., May 15, 16, 17 and 18. It contains a thorough discussion on the following subjects: Powdered Coal, Storage Coal, Fuel Stations, Front End Grates and Ash Pans, Care of Locomotives with Relation to Fuel Economy, Coal Distribution Record System, the Functions of a Railroad Fuel Inspector, the Human Fireman, the Influence of an Intimate Knowledge of Coal on Fuel Economy on the Efforts of Enginemen and Others, Interpretation of Coal Analysis With Special Reference to Non-Combustibles, What the Transportation Official can do to Promote Fuel Economy, and a paper by S. M. Felton, president, Chicago Great Western, on the Fuel Problem, Past and Present.

*Preliminary Mathematics.* By Prof. F. E. Austin. Bound in cloth; 170 pages; 5 in. by 7½ in. Published by Prof. F. E. Austin, Hanover, N. H. Price, \$1.20.

A book which will furnish a connecting link between arithmetic and algebra has been badly needed. Prof. Austin has tried to show the connection between the common operations of arithmetic and the corresponding algebraic processes so as to make it easy for the student to gain a practical knowledge of algebra and its application. From the simplest operations the author proceeds to the treatment of roots, logarithms, linear and quadratic equations and series and progressions.

## COMMUNICATIONS

### ALTERING LOCOMOTIVE FRONT ENDS

DOUGLAS, Ariz.

TO THE EDITOR:

I was very much impressed with the editorial on page 220 of the May issue, under the heading "Altering Locomotive Front Ends." It is timely and to the point. However, it appears strange to me that you did not plant both feet firmly on the proposition instead of just stepping on it with one foot.

The true proportions of the front end draft appliances being once determined and proved, there should be no more occasion to alter them than to change the proportions of an injector designed to perform a certain work. The function of the exhaust nozzle, in conjunction with the stack, is simply to create, by means of the steam jet, the greatest possible vacuum in the front end without impairing the efficiency of the locomotive through excessive back pressure.

Tests have proved that the nozzle area can be accurately predicated on the cylinder volume, and that the ratios of nozzle opening and height, stack area and length can be positively determined. It may be necessary in some cases to extend the stack into the front end in order to get the length required, but this problem presents no mechanical difficulty.

The function of the diaphragm or deflecting plate is, as its name implies, to deflect or give direction to the current of gases passing through the tubes, while that of the draft sheet is to regulate the volume that can be emitted in a given period of time, so as to produce a practically even flow of gases through all tubes. In addition to this, the draft sheet also aids in so directing the current of gases that any cinders carried with this current impinge against the front end door at such an angle as to cause them to be broken up small enough to pass through the netting. In other words, the diaphragm plate and draft sheets act as a draft regulator or distributor and front end cleaner. As the position of these plates can be definitely determined by experiment, it follows that given a certain type of locomotive the position and dimensions of the various draft appliances can be arrived at with an experimental locomotive, and then be permanently adjusted on all of that type from the data obtained.

The desire to "monkey" with the front end arrangements is a survival of the day of the old diamond stack, long petticoat pipe, and personal ownership of the locomotive by the engineer and fireman, where each adjustment was made to suit the whim of the engine crew. In this day of pooled power, however, if the front end appliances were changed to suit the firing methods of every fireman, it would only result in continual adjustments without any definite results; whereas, if the position and dimensions of the various appliances are fixed to produce known results, it follows that in case of steam failures the real seat of the trouble will be located and corrected. This may be found in the firing method, in the manner in which the engine is handled, in steam losses due to defective cylinder packing, valve seats or rings, steam pipe or nozzle joints, or last but not least, insufficient air opening under the fire. Perhaps, on the whole, it would be advisable to begin our investigations and draft adjustments from the firebox end, as all do not appreciate the necessity of ample air openings to the ashpan and through the grates, the belief being prevalent in some parts that draft action or fire stimulation is somewhat similar to lifting a bale of hay with a grab hook, i. e., a pulling action, instead of realizing that draft action is due to difference in

atmospheric pressure above and below the fire, regardless of whether this difference is produced by decreasing the pressure above the fire by means of a partial vacuum as in the locomotive firebox, or by increasing the pressure below the fire through a forced air jet as is done in the blacksmith's forge.

The permanent adjustment of draft appliances is entirely practicable and feasible on all classes of locomotives. It has been done on this road, and is being done on the Pennsylvania System, and when the practice becomes more universal, another step in the matter of fuel economy will be a *fait accompli*; for so long as the fireman can with any degree of assurance attribute steam failures to a defect in draft adjustments, so long will a spirit of indifference dominate his firing methods, and indifferent workmanship in any occupation spells but one thing, waste.

F. P. ROESCH,

Master Mechanic, El Paso & Southwestern.

### TOBESURA WENO "ON THE MAT"

(With Apologies to Wallace Irwin.)

DEAR EDITOR: I am writing you to warn of possible disappearance from view soon on account of discipline. I receive summons of late to report Big Chief at Washington. I hasten to comply and am greeted by full force U. S. Chief Detectors.

Hon. Assistant inquire if I am off or from. I place feet at proper angle according to secret code and emit—"both, mister assistant, off my job and from my district."

"You know the rules," he assume softly?

"Yes, Hon. boss," I reply with tremble in voice.

"You are accuse of interfering with legislative matter, giving aid to brotherhood enemy, betraying secret of inspection job to corporation-own magazine (this refer to you) and writing letter to editor casting inflection on U. S. I. C. C. bureau."

I deny fact in totem, refer to insidious lobby and throw myself on mercy four leader which compose jury. I weep great salt tears like brotherhood chief when he demonstrate hard life rr trainmen and assume look of aggrieved angel. I drop on knee with hand outstretch and swear forever loyalty first to Hon. brotherhood, second to four chief, third to Hon. boss and last if any left to U. S. government. I suspect four chief with thumbs turn down which mean trouble for innocent detector. On order boss, I remain in suspense until jury award penalty.

While await verdict, I sadly walk street and conceive scheme to visit Hon. law manufacturers who distribute seed and pork-barrels, make headlight, safety appliance and eight-hour laws with bogus attached. During show I see courageous senator from Iowa filibuster ten days to obstruct appointment of Hon. Daniels on I. C. C. board; I behold frenzy finance arrive from Boston arm with bombs and hearsay evidence for indicating Mr. President, Hon. brother-in-law and son-in-law for writing peace notes to Wall street; see Josephus Daniels (who rejuvenate navy) insult American patriots in steal plant by order shell from London and almost get deport for undesired spy account peacefully picket I. C. C. boarding house in super anxiety to hold job.

This suspense are bad on boiler, flue and tire and if I am not soon restated with honor, I propose last card to Chief by issue Form 5 on poor jap detector. This will affect boss as joke and maybe save job. I hope, hon. editor things have not arrive that pass where faithful and relentless persecution of heartless RR corporation lose honest worker job or reduce him to involuntary servitude. If Big Chief decide satisfactory, I am going to wireless you in secret code—so—IT ARE REPORTED THAT A GREAT FIRE ARE RAGING IN TORONTO.

Yours truly,

TOBESURA WENO.

# PENNSYLVANIA LOCOMOTIVE TESTS

The Testing Plant of Great Value in the Determination of Correct Locomotive Proportions

BY ANDREW C. LOUDON

THE *Railway Mechanical Engineer* has frequently referred to the work that has been done on the Pennsylvania Railroad in the past few years in the way of locomotive development, but little has been published regarding the actual performance, in detail, of the locomotives as determined on the testing plant at Altoona. It is proposed, therefore, to give some account of the general performance of the three types which have so far been developed to a condition of economy and capacity which has warranted their building in considerable numbers. These types are the Atlantic (Pennsylvania Railroad class E6s), Pacific (class K4s) and Mikado (class L1s). The Atlantic type engine was described in the February, 1914, issue of the *Railway Age Gazette, Mechanical Edition*, and the other two in the issue of July, 1914. The results of the tests of the Pacific and Mikado types will be dealt with later. The figures given in this article are from Locomotive Testing Plant Bulletin No. 27 of the Pennsylvania Railroad, entitled "Tests of a Class E6s Locomotive." (Copyright 1915 by the Pennsylvania Railroad Company.)

The development of the most recent form of the Atlantic type locomotive on this road extended over a number of years and the testing plant at Altoona took a prominent part in it. In 1910 a locomotive of the E6 class using saturated steam was built. In 1912 this locomotive had a superheater added and its classification was changed to E6s. One more locomotive of the E6s class was built at this time and one class E6sa, differing from the others in having a special valve and valve gear. There were then two E6s and one E6sa locomotives; these had tubes 13 ft. 8 $\frac{5}{8}$  in. long and cylinders 22 in. by 26 in. In 1913 the three locomotives were rebuilt with new cylinders 23 $\frac{1}{2}$  in. by 26 in. and with other changes, but with no change in tube length. After June 1, 1913, a large number of locomotives of the E6s class with 15-ft. tubes were built, and one of these latter, No. 51, is the subject of this article. The E6 and E6sa classes no longer exist. There are now no locomotives like Nos. 89 and 5075, figures for which are given, in comparison with those obtained from No. 51, which is the finally adopted form of the E6s class.

The general dimensions of the two locomotives of the E6s class are as follows:

	Old E6s No. 89	New E6s No. 51
Total weight, working order, lb.....	234,200	240,000
Weight on drivers, working order, lb.....	141,000	133,100
Cylinders (simple), diam. and stroke, in....	22 by 26	23 $\frac{1}{2}$ by 26
Driving wheels, diameter, in.....	80	80
Heating surface, tube (water side), sq. ft..	2,404.9	2,634.5
Heating surface, firebox, including arch tubes, sq. ft.....	254.5	232.7
Heating surface, superheater (fireside), sq. ft. ....	688.8	810.6
Heating surface, total (based on water side of tubes), including superheater, sq. ft..	3,348.2	3,677.8
Heating surface, total (based on fireside of tubes), including superheater, sq. ft....	3,089.5	3,405.6
Grate area, sq. ft.....	55.23	55.79
Boiler pressure, lb. per sq. in.....	205	205
Valves, type .....	14 in. piston Walschaert	12 in. piston Walschaert
Valve gear .....	Wide, Belpaire	Wide, Belpaire
Firebox, type .....	242-2 in.	242-2 in.
Tubes, number and outside diameter.....	36-5 $\frac{3}{8}$ in.	36-5 $\frac{3}{8}$ in.
Flues, number and outside diameter.....	164.63	179.71

Both locomotives were equipped with brick arches.

Experiment has shown that there is a point beyond which the lengthening of the tubes fails to produce a proportional increase in evaporation, the effect being partly due to the resistance to the flow of gases and the retardation of combustion. But for best results the tubes should be extended fully up to the point where the increase in evaporation ceases to be propor-

tional to the increase in length. It has been found on the Pennsylvania that the most desirable length for a tube is about 100 times its internal diameter and this rule has been adopted with a leeway to the designer of 10 or 15 per cent to satisfy other boiler conditions. In the first E6 boiler the tubes had a ratio of length to internal diameter of 94; in the new boiler, with 15-ft. tubes, the ratio is 103.

It will be noted that the final form of the E6s locomotive uses a 12-in. diameter piston valve, while the original engine had 14-in. valves. It has been found that this is entirely practicable from the fact that superheated steam flows through the steam passages with greater freedom than saturated steam of the same pressure, making it possible to restrict the passages to some extent. The entire design of piston valve and valve gear has been completely revised, the gear being much lighter and at the same time giving greater rigidity. The new form of valve is shown in Fig. 1.

The reciprocating parts of this latest engine are remarkable for their light weight, and in spite of the fact that the maximum weight on a pair of drivers is now 67,000 lb. the dynamic augment or the increased pressure on the rail due to the unbalanced revolving weights at 70 miles an

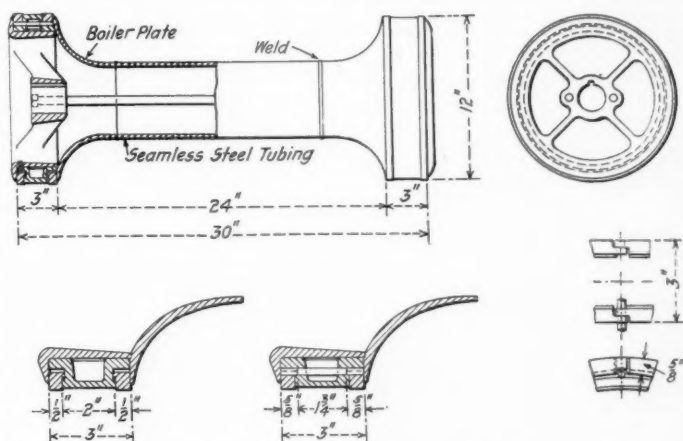


Fig. 1—Piston Valve Used in the Class E6s Locomotives

hour, is less than 30 per cent of the static weight on the drivers; or no greater than that with many locomotives having from 10,000 to 12,000 lb. less weight per axle, but with heavy reciprocating parts. The great care in the design of these reciprocating parts has made possible a locomotive of this type which is more powerful than many locomotives of the Pacific type, while it has less destructive action on the track. The light weight of the reciprocating parts of this and other Pennsylvania Railroad locomotives is shown clearly in a series of articles by H. A. F. Campbell in the *Railway Age Gazette, Mechanical Edition*, for March, April, May and September, 1915.

## BOILER PERFORMANCE

The coal used in the tests of No. 51 was the same as that used with No. 89, being bituminous from Westmoreland county with 58.45 per cent carbon, 33.65 per cent volatile matter, 1.54 per cent moisture and 6.36 per cent ash, the sulphur, separately determined being 1.62 per cent. This fuel has a heat value of 14,470 B. t. u. per lb., dry, and 14,513 b. t. u. per lb. of combustible.

The exhaust nozzle used in No. 51 was of a type devel-

oped on the Pennsylvania and now in general use on that road. It has four internal projections or partial bridges. These break up the continuity of the stream from the nozzle to a certain extent, which has proved advantageous. This nozzle was described in the *Railway Age Gazette, Mechanical Edition*, for April 1915. One of these nozzles, with an area of 30.68 sq. in., or equivalent to a 6.25-in. diameter circular nozzle, gave the highest actual evaporation, 44,628 lb. of water per hour. A similar nozzle with an area of 27.06 sq. in. produced a maximum evaporation of 42,420 lb. per hour at a speed of 240 r.p.m. with a cut-off of 45 per cent. The maximum evaporation of 44,628 lb. was at a rate of 5.4 lb. of water per lb. of coal, or an equivalent evaporation of 7.09 lb. of water per lb. of dry coal, the superheat being 204 deg. and the boiler efficiency 48.59 per cent.

After a few tests of No. 51 it was found that the smokebox was not cleaning properly. The pocket in the diaphragm plate around the nozzle was made of a solid plate instead of netting, and an extension was made at the forward end of the diaphragm plate. This corrected the smokebox trouble. The following table shows the smokebox draft:

Pounds of water evaporated Per hour, actual	Draft in smokebox, in. of water			
	Right side	Left side	Top	Bottom
15,492.....	1.5	1.5	1.4	1.1
20,200.....	2.1	2.1	2.1	2.2
24,645.....	3.2	3.3	3.1	3.1
30,008.....	4.3	4.2	4.0	3.4
35,238.....	5.8	5.7	5.6	...
40,063.....	8.1	7.8	7.7	8.5
44,628.....	9.6	9.3	9.3	10.1

In front of the diaphragm the draft increased to 15.1 in. of water when the rate of firing reached 150.56 lb. of coal

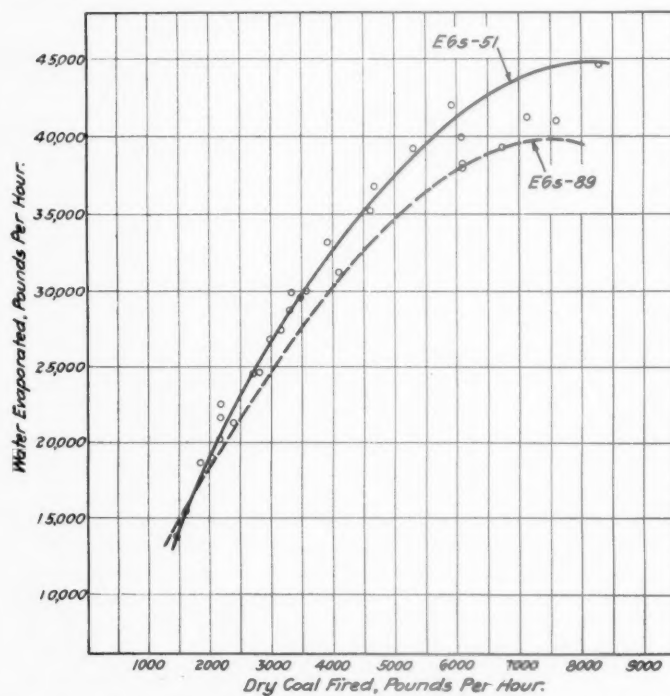


Fig. 2—Relation of Dry Coal Fired to Water Evaporated

per sq. ft. of grate per hour; the draft back of the diaphragm was 9.4 in.; in the firebox 3.5 in. and in the ashpan 0.40 in.

The vacuum in the ashpan is somewhat higher than that obtained with No. 89. At a speed of 200 r.p.m. and 50 per cent cut-off, the rate of combustion for No. 51 was 148.25 lb. of coal per sq. ft. of grate per hour and the vacuum in the ashpan was 0.40 in., while No. 89 burned 142.17 lb. of coal per sq. ft. of grate per hour with 0.15 in. vacuum. The area of the air inlets to the ashpan of No. 89 was 8.1 sq. ft., or 14.6 per cent of the total grate area. On locomotive No. 51 the corresponding figures are 7.85 sq. ft., or 14 per cent.

That the longer boiler tubes absorb more heat was indi-

cated by slightly lower smokebox temperatures in No. 51 than in No. 89. In the new engine the temperatures ranged between 436 and 663 deg. F., being always below 700 deg. F., while in No. 89 the smokebox temperature reached as high as 770 deg. F.

The dry coal fired per hour ranged between 1,477 and 8,271 lb., and the rate of combustion per sq. ft. of grate per hour from 26.47 lb. to 148.25 lb. Based on a square foot of heating surface it ranged between 0.434 and 2.429 lb. The heat absorbed by the superheater ranged from 6 to 9.5 per cent, or less than 10 per cent of that absorbed by the water heating surfaces. The combustion rate increased regularly with the draft up to a rate of firing of approximately 148 lb. of dry coal per hour per sq. ft. of grate, when the maximum draft obtained was 15 in. of water. The indications

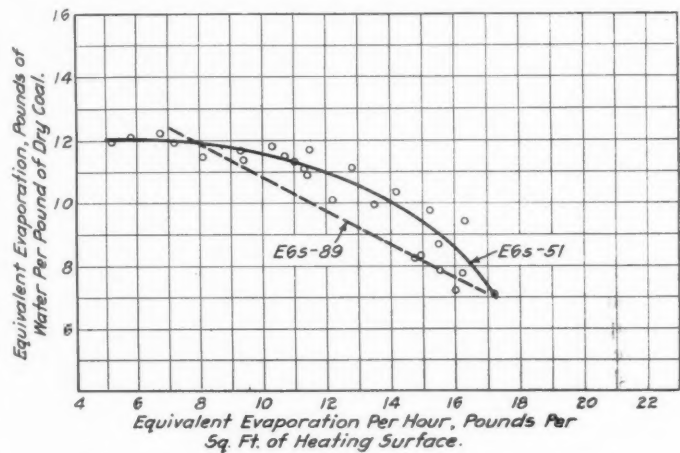


Fig. 3—Equivalent Evaporation per Pound of Dry Coal

were that with a further material increase in the rate of firing the draft would have been insufficient to promote good combustion. At the maximum rate of combustion, the distribution of the draft was 20 per cent in drawing air through the fuel bed, 40 per cent in moving the gases through the tubes and 37 per cent in drawing the gases from the back to the front of the diaphragm. The corresponding figures for No. 89 were 18.3 per cent from ashpan to firebox, 29.5 per cent from firebox to back of diaphragm, and 51 per cent from back to front of diaphragm. It is again evident that the lengthening of the tubes has proved advantageous, but locomotive No. 51 might have been the better for an increased ashpan air opening.

With an increase of heating surface over No. 89 of 10 per cent, No. 51 increased the maximum evaporation 15 per cent, or from 38,846 lb. per hour to 44,600 lb. per hour. This is shown by the curves in Fig. 2.

The boiler efficiency shows substantial improvement, ranging in the case of No. 51 between a figure of about 83 per cent at an evaporation rate of 18,000 lb. per hour, and slightly below 50 per cent at about 44,000 lb. per hour. As the curves for the two engines do not follow the same form, it is difficult to obtain exact figures of general comparison. However, plotting the boiler efficiency of the two locomotives on a base of dry coal per hour per sq. ft. of grate, the curves for both engines are straight lines and are parallel, the efficiency for No. 51 being about 9 per cent above that of No. 89. At a rate of about 40 lb. of dry coal per hour per sq. ft. of grate, the efficiency of the boiler of No. 51 is in the neighborhood of 83 per cent, dropping to about 50 per cent at 140 lb. per hour. The equivalent evaporation per lb. of coal is about 9 per cent greater for No. 51 than for No. 89, the range for No. 51 being between 12.5 lb. per lb. of dry coal at about 35 lb. of dry coal per hour per sq. ft. of grate and 7 lb. at a rate of 150 lb. of coal per hour.

Fig. 3 shows comparisons between the evaporations per lb. of coal at all rates of evaporation. This again shows im-

proved results for No. 51 up to the maximum rate, where the two lines meet. The maximum rate of equivalent evaporation for No. 51 is 17.22 lb. per sq. ft. of heating surface per hour.

The maximum superheat obtained with No. 51 was 12.5 deg. above that obtained from the short tube boiler of No. 89, the range in superheat in the case of No. 51 being between 137 and 251.3 deg. F.

The shorter tube boiler showed a greater activity of com-

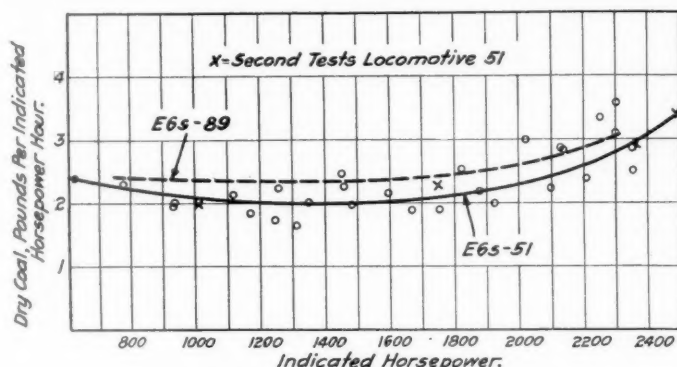


Fig. 4—Coal Rate and Indicated Horsepower

bustion for like drafts, but there was very little difference in the rapidity of evaporation in the two boilers until a draft of five inches of water was obtained back of the diaphragm. The shorter tube boiler then showed a more rapid rate until its evaporation limit was reached.

#### ENGINE PERFORMANCE

The efficiency tests made with No. 51 on the testing plant were at speeds between 28.1 miles per hour (120 r.p.m.) and 84.4 miles per hour (360 r.p.m.), the nominal cut-offs being between 15 and 50 per cent.

At a speed of 28.1 m.p.h., and 15 per cent cut-off, the indicated horsepower was 620.3, while at 75 miles per hour and 35 per cent cut-off it was 2,357.2. In a second series of tests the indicated horsepower reached 2,488.9, or a horse-

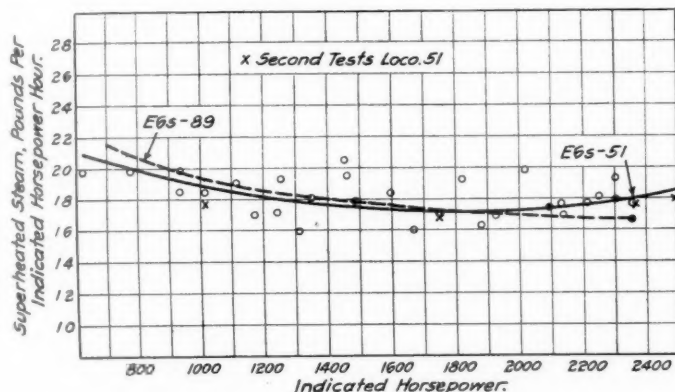


Fig. 5—Relation of the Water Rate to Indicated Horsepower

power for each 96.5 lb. of total weight. The following tables give the figures for the two series of tests:

FIRST TESTS, JUNE AND JULY, 1914					
Boiler pressure	Superheat, deg. F.	Steam to engines, lb. per hour	Indicated horsepower	Dry coal per i.h.p. hour, lb.	Steam per i.h.p. hour, lb.
206.0	145.6	18,627	1,011.7	2.0	18.4
202.6	246.7	41,208	2,302.1	3.1	17.9
204.9	204.2	44,530	2,304.8	3.6	19.3
206.0	216.0	41,631	2,357.2	2.5	17.7
SECOND TESTS, DECEMBER, 1914					
205.0	139.8	17,826	1,015.8	2.0	17.6
204.5	179.6	41,986	2,366.3	2.9	17.7
201.7	228.3	44,583	2,488.9	3.4	17.9

The coal rate per indicated horsepower hour did not exceed 3.6 lb. in the first tests, and with the exception of four tests the coal consumption was below 2.9 lb. per i.h.p. hour. The

steam rate per i.h.p. hour ranged between 16.07 and 20.56 lb. The maximum steam temperature reached (in the branch pipe) was 635.7 deg. F., or 251.3 deg. F. of superheat. The superheat in general was below 230 deg. F., there being little difference in the superheat obtained in No. 51 and No. 89. In neither case was the superheat below 137 deg. F.

The steam consumption per indicated horsepower hour is much the same for both No. 51 and No. 89 up to about 1,800 i.h.p., beyond which the rate for No. 51 rises slightly. However, under what may be considered normal working conditions, or between 1,200 and 2,000 i.h.p., the rate of water consumption of No. 51 is very satisfactory. The coal per i.h.p. hour is lower for No. 51 than for No. 89 at all rates, due to the better boiler performance. This is shown in Fig. 4, and the water rate in Fig. 5. At horsepowers above 1,800, the tests of locomotive No. 51 show that the larger cylinders use slightly more steam than the cylinders of No. 89, but considering the coal rate and the increased boiler efficiency, the locomotive as a whole shows considerable improvement.

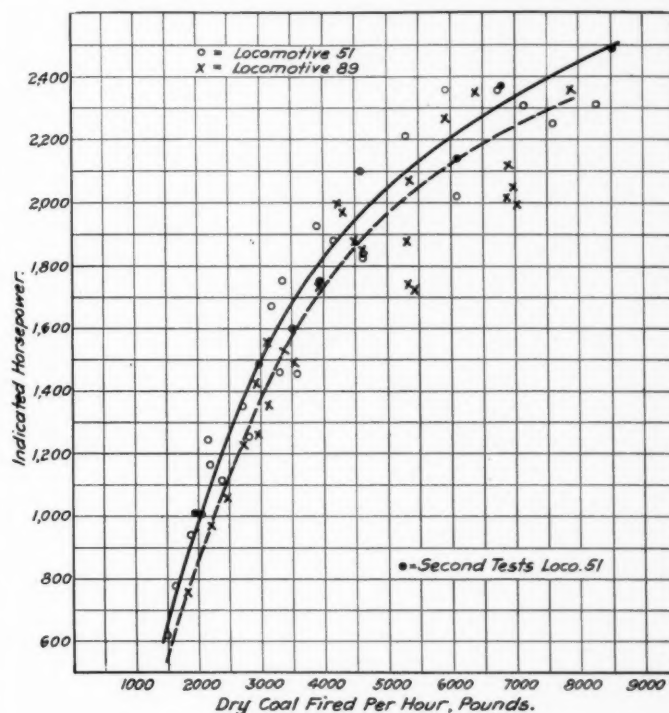


Fig. 6—Coal Fired and Indicated Horsepower

Attention is called to the fact that with No. 89, the maximum indicated horsepower obtained was 2,355.2 at a speed of 360 r.p.m. or 84 m.p.h., and a cut-off of 36.1 per cent.

The curves in Fig. 6 show that No. 51 develops a greater horsepower than No. 89 at every rate of firing.

A single curve fairly represents both locomotives when steam per i.h.p. hour is used as a base for plotting piston speed. Such a curve shows an improvement in steam consumption with an increase in piston speed up to 1,200 ft. per minute. The rate falls from about 20 lb. at 500 ft. per minute, to 17 lb. at 1,200 ft. per minute.

Considering the efficiency of the engines, and taking the Rankine cycle as a base for an ideal engine, it is found that such an engine has an efficiency of 33.67 per cent. Considering this as 100 per cent, the actual engines developed an efficiency which was 67.8 per cent of the ideal. While from 11.6 to 14.1 per cent of the actual heat in the steam was turned into work (thermal efficiency), the engines approached within 33 per cent of the perfect engine. As the power increases there is an increase in the thermal efficiency which decreases again at maximum power. With an indicated horsepower output between 600 and 2,400, the actual engines of these locomotives use from 11 to 14 per cent of the heat in

the steam and discharge the rest to the exhaust. If the ideal engine could replace the actual engine, it could perform the same functions under identical conditions with approximately 60 per cent of the actual engine's steam consumption. As the rate of steam consumption decreases, with increased speed and shortened cut-off, this loss of power becomes less and the performance of the actual engine approaches that of the ideal as a limit.

For locomotive No. 89 the efficiency reached 86.5 per cent of the ideal. This was at about 85 miles per hour. The large amount of heat rejected in the exhaust (from 86 to 89

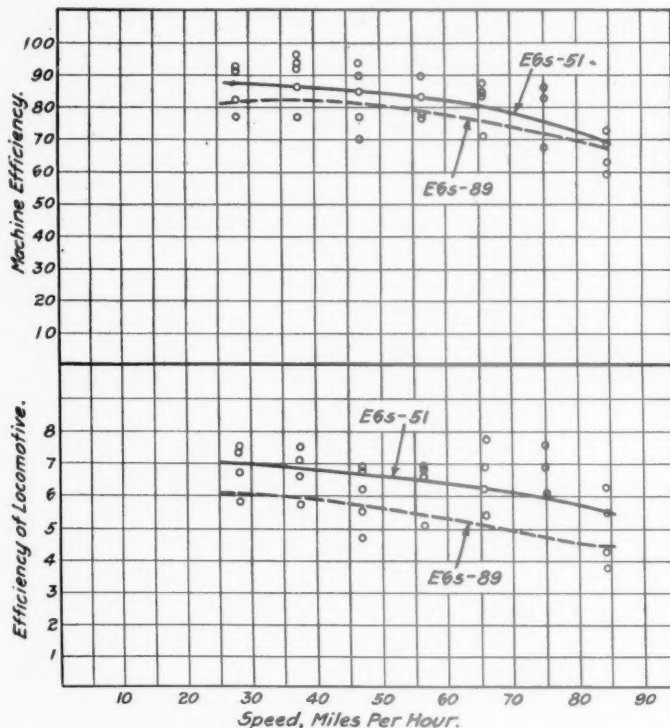


Fig. 7—Machine and Locomotive Efficiency Curves

per cent) is indicative of the further saving possible by the use of a feedwater heater on locomotives using superheated steam. But the actual value of the superheater is conclusively shown in the table, which gives the comparative performance at equal weights of steam, and at a speed of 48 miles per hour, for three locomotives, No. 51, No. 89, and No. 5075, the latter the class E6 engine, using saturated steam. This engine had cylinders 22 in. in diameter, the same as those

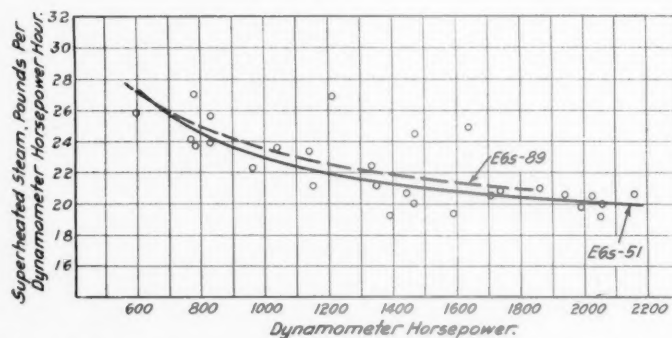


Fig. 8—Steam Consumption per Dynamometer Horsepower-Hour

of No. 89. Not only is greater power possible, but the advantage of a shorter cut-off is available over a greater range when the diameter of the superheater locomotive cylinder is increased above the limitations established by the use of saturated steam.

Locomotive No. ....	51	89	5075
Class .....	E 6s	E 6s	E 6
Steam per hour, lb. ....	37,713	38,028	37,335

Steam per i. hp. hour, lb. ....	17.70	18.86	24.14
Indicated horsepower .....	2,131	2,016	1,546
Mean effective pressure, lb. ....	95.97	104.1	79.0
Cut-off, per cent of stroke .....	45	55	32
Superheat, deg. F. ....	245.6	237.0	None

The following tables give the results of tests for determining the performance of locomotive No. 51 at the drawbar:

FIRST TESTS, JUNE AND JULY, 1914					
Speed, miles per hour	Drawbar pull, lb.	Dynamometer horsepower	Coal per d. hp. hour, lb.	Steam per d. hp. hr., lb.	Mach. eff'cy of loco., per cent
56.4	13,691	2,060.2	3.5	20.0	89.5
56.4	5,201	782.6	2.6	23.8	77.4
46.9	17,293	2,162.3	3.8	20.6	93.8
75.0	10,129	2,026.4	2.9	20.5	86.0

SECOND TEST, DECEMBER, 1914					
Speed, miles per hour	Drawbar pull, lb.	Dynamometer horsepower	Coal per d. hp. hour, lb.	Steam per d. hp. hr., lb.	Mach. eff'cy of loco., per cent
55.7	4,819	716.4	2.8	24.9	70.5
55.7	14,297	2,125.3	3.2	19.8	89.8
55.7	15,138	2,250.4	3.8	19.8	90.4

The maximum drawbar or dynamometer horsepower obtained was 2250.4, with a coal rate of 3.8 lb. per dynamometer horsepower hour.

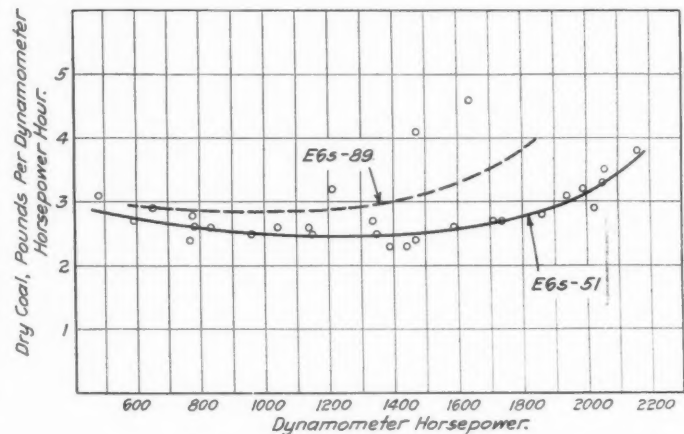


Fig. 9—Dry Coal per Dynamometer Horsepower-Hour

meter horsepower hour and a steam rate of 19.8 lb. The coal rate for all tests was generally below 3 lb. Locomotive No. 51 developed a maximum dynamometer horsepower about 17 per cent greater than that of No. 89. The machine effi-

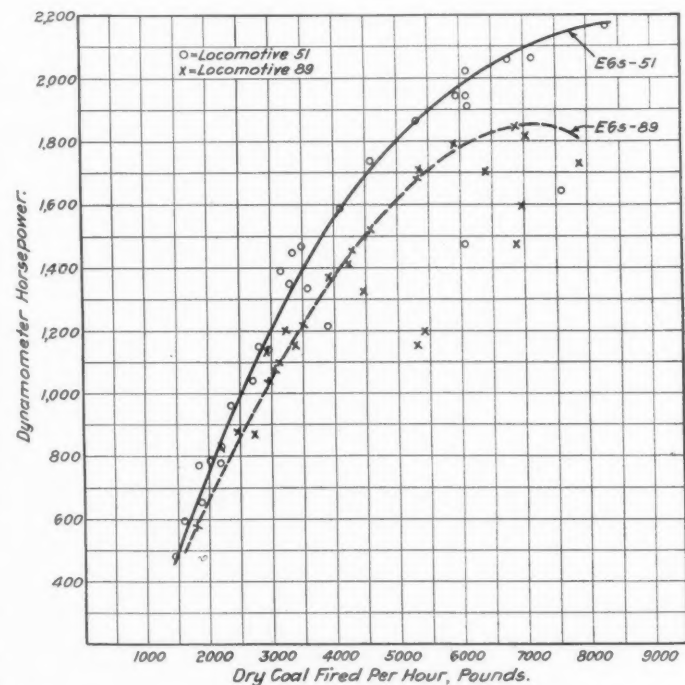


Fig. 10—Relation of Dynamometer Horsepower to the Rate of Firing

ciency ranged between 59.3 and 96.2 per cent, being higher for locomotive No. 51 than for No. 89. The thermal efficiency ranged between 3.8 and 7.8 per cent, being higher for

No. 51 than for No. 89, because of the better boiler performance of the former. This is shown in Fig. 7.

In the curves showing steam per dynamometer horsepower hour, Fig. 8, No. 51 is shown to develop a maximum horsepower which is 17 per cent above that of No. 89, while the steam rate is slightly lower than that of No. 89. In the coal rate, No. 51 has a considerable advantage over No. 89 at

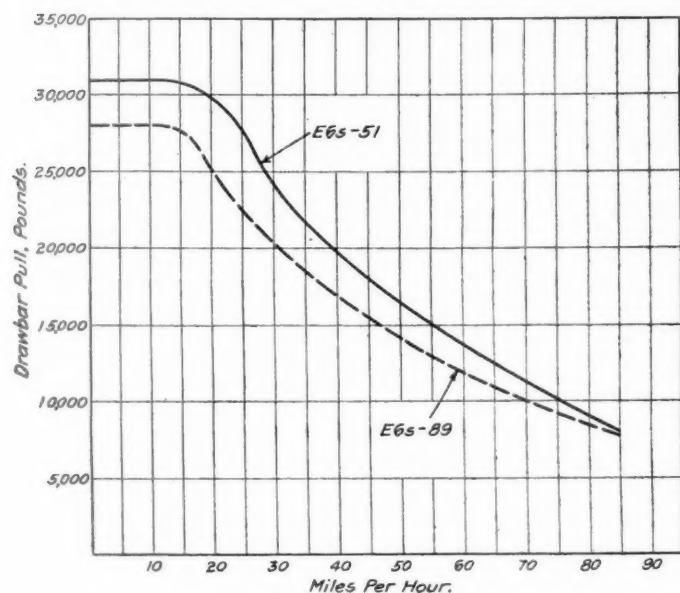


Fig. 11—Drawbar Pull Curves

all horsepowers, as shown in Fig. 9. Fig. 10 shows dynamometer horsepower on the basis of dry coal fired per hour. It is evident from the curves that No. 51 has a decided advantage over No. 89, the horsepower being greater at all rates of firing. When the firing rate is 7,000 lb. per hour, the horsepower developed by No. 51 exceeds that of No. 89 by 250, or 13.5 per cent.

In the curves of drawbar pull, Fig. 11, the advantage of

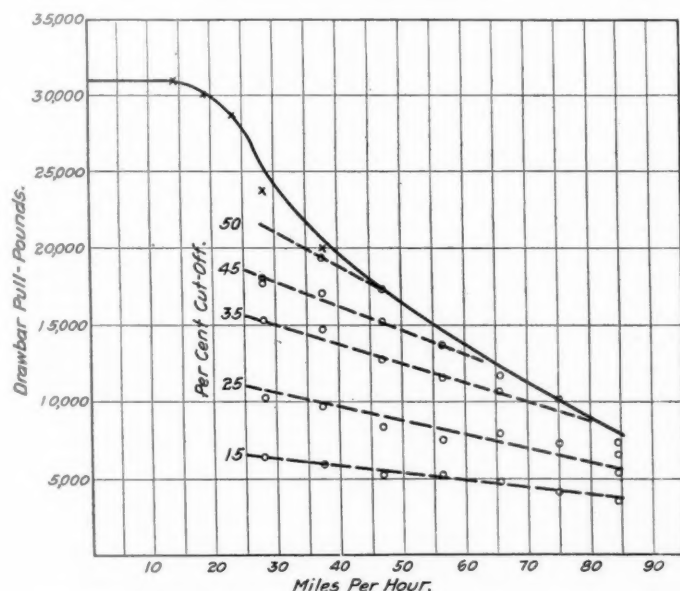


Fig. 12—Maximum Drawbar Pull at Various Points of Cut-Off

the larger cylinders of No. 51 is in evidence, a greater drawbar pull being maintained by this engine at every speed up to 85 miles an hour.

An interesting feature of the drawbar pull tests is shown in Fig. 12. The straight lines show the drawbar pull at the various cut-offs given, and indicate a falling off in pull as

the speed increases. It is believed that this is due to losses of pressure in the cylinder as the piston speed increases.

#### CONCLUSIONS

These tests are indicative of what can be accomplished by careful study in the designing of locomotives, and the advantages to be obtained by the co-ordinate use of a testing plant with the work of the designer. When No. 89 was equipped with a superheater it was reasonable to expect that the engine represented the highest development in the way of power production in locomotives of this type. But the further improvements made—increasing the length of tubes and the size of the cylinders—provided a locomotive which has developed a maximum indicated horsepower of 2488.9 at a speed of 56 miles per hour—a horsepower for each 96.4 lb. of total weight and for each 53.4 lb. of weight on drivers—and a maximum drawbar horsepower of 2250.4, at a coal rate of 3.8 lb. and a steam rate of 19.8 lb. per drawbar horsepower hour. Thus, a substantial improvement in the economy of the locomotive was secured, together with an increase of over 20 per cent in the maximum drawbar horsepower delivered.

It is seen that, to the owners of this equipment, such tests bring a return in increased power and economy throughout the life of the locomotive, many times greater than the cost of the design study and test plant operation.

As described in this review, the determination of the fundamental proportions of the boiler and engines must often be made within close differences requiring means of making tests in which the conditions can be duplicated as exactly and as many times as need be, and since conditions in service make such duplication in tests on the road impossible, the suggestion would seem to be, particularly to those not well equipped for selecting and trying out their locomotives, that the locomotive testing plant furnishes the only means for the solution of problems of this character.

#### RAIL PRESSURE FROM MAIN ROD THRUST

BY J. PAUL SHAMBERGER

Interstate Commerce Commission reports show that for the 10-year period just ended there were 2,792 accidents in the United States due to broken rails. These accidents caused the death of 175 people, the injury of 5,952 and damaged roadbed and equipment to the amount of \$3,330,716. As rails are broken by the weight which comes upon them, it might be well, in consideration of the above statistics, to thoroughly investigate the possible maximum pressure to which a rail is subjected. The heaviest wheel loads of a train occur under the locomotive drivers. It is customary, however, in estimating the rail pressure under locomotive driving wheels to consider only the static weight of the engine and the centrifugal force from the unbalanced portion of the counterbalance. It is not customary to consider the rail pressure due to the vertical component of the main rod thrust or pull. This thrust, of course, affects only the main drivers, but it is here that the maximum rail pressure is obtained, and it is the purpose of this article to show that this main rod thrust should be considered.

The magnitude of the vertical component of the main rod thrust is equal at all times to the cross head pressure against the guides. Its intensity depends upon the position of the crank pin and upon the steam pressure against the piston. The only crank pin position considered here is with the pin directly above the center of the axle. For this condition the vertical component will augment that of the rail thrust due to the centrifugal force of the unbalanced portion of the counterbalance. It is assumed that the center line of the cylinder passes through the center of the axle. Due to the cross-head pressure against the guides the weight under a locomotive's wheels at rest is different from that when the locomotive is working steam. This re-distribution of weight,

however, is of negligible importance since it changes the rail pressure so slightly.

The inertia of the reciprocating parts need not be considered, for with the crank pin directly over the axle this inertia is zero.

A Pacific type locomotive of the following dimensions will be considered as a concrete example for this discussion:

Cylinders, 23½ in. diam. by 28 in. stroke.  
Length of main rod, 107 in.  
Diameter of drivers, 73 in.  
Boiler pressure, 175 lb.  
Weight on drivers, 157,500 lb.  
Weight of unbalanced portion of main driver counterbalance at crank pin radius, 304 lb.

In Fig. 1 is shown the relation between the steam pressure (net) against the piston and the increase in rail pressure from the main rod component.

Let  $V_{cr}$  = the vertical component of the main rod thrust in pounds,

$A$  = piston area in sq. in.,

and  $a$  = angle shown in Fig. 1 = 7 deg. 30 min.

Then  $V_{cr} = A \times P \times \tan a = 433.7 \times P \times .131$

or  $V_{cr} = 56.7 P$ .....(1)

From indicator cards the steam pressure in the cylinder at midstroke (the position at which the main rod exerts its greatest thrust on the rail) will vary according to the speed as follows:

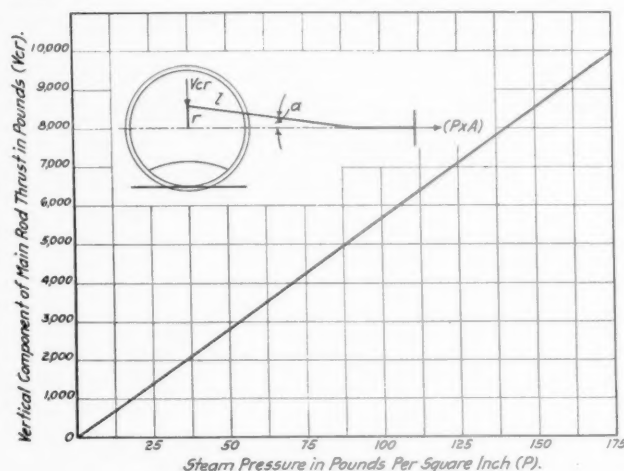


Fig. 1—Rail Thrust from the Main Rod

Zero m.p.h.	175 lb.
10 m.p.h.	170 lb.
20 m.p.h.	162 lb.
30 m.p.h.	150 lb.
40 m.p.h.	133 lb.
50 m.p.h.	112 lb.
60 m.p.h.	84 lb.
70 m.p.h.	52 lb.

The rail thrust corresponding to these pressures has been plotted in Fig. 2 and is designated as  $B$ . On this same chart the relation between the speed of the engine and the centrifugal force of the unbalanced portion of the counterbalance is shown at  $A$ . Curve  $A$  was obtained as follows:

Let  $V_{cc}$  = rail pressure due to the centrifugal force of the unbalanced portion of the counterbalance in pounds.

m.p.h. = miles per hour.

$S$  = stroke of the piston in inches.

$R$  = wheel radius in inches.

$M$  = engineer's mass of unbalanced portion of counterbalance.

$v$  = velocity, in feet per second, of  $M$ .

$r$  = distance in feet from the center of axle to the center of  $M$ .

$$\text{We then have } V_{cc} = \frac{M \times v^2}{r} = \frac{304 \left( \frac{\text{m.p.h.} \times 5280}{3600} \times \frac{S}{R} \right)^2}{1.167}$$

or  $V_{cc} = 2.55 \text{ m.p.h.}^2$ .....(2)

In Fig. 3 is shown the total rail pressure due to the weight of the locomotive, the centrifugal force of the unbalanced portion of the counterbalance, and the vertical component of the main rod thrust. The "Probable highest value of  $P$ " was obtained from the indicator cards above referred to.

The curve  $C$ , Fig. 2, is a summation of the curves  $A$  and  $B$  and shows plainly the increase in rail pressure from the main rod thrust. When working steam at 60 m. p. h. the rail pressure from the main rod of this Pacific type engine increases that from the counterbalance by slightly more than

50 per cent. Curve  $C$  shows also that rails are subjected to a high pressure not only from engines at high speed but also from those at slow speed when using steam. When this specific engine is starting its train the pressure from the main

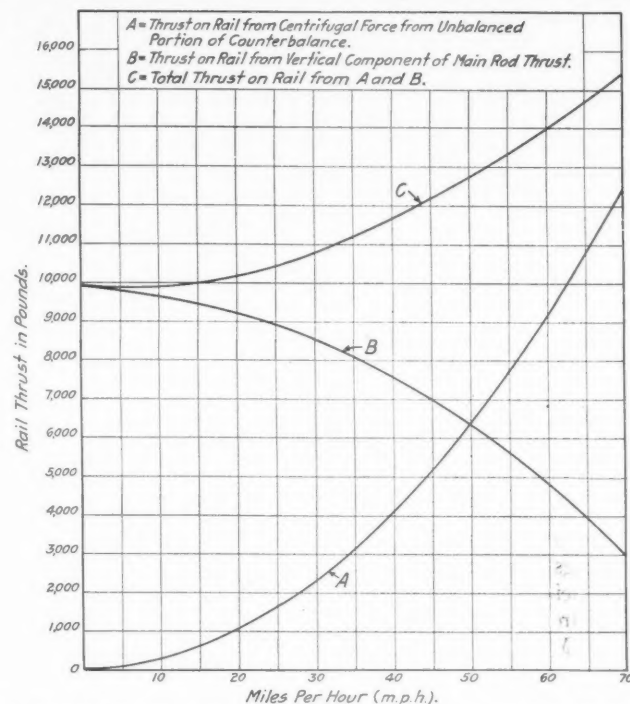


Fig. 2—Rail Pressure from the Counterbalance and Main Rod Thrust

rod is equal to that from the counterbalance at 62 m. p. h. The magnitude of the so-called counterbalance "blow" (which is not a blow at all, but is a pressure that is gradually applied according to a sine wave) from locomotives at high speed is generally appreciated, but curve  $C$  shows how a low speed freight engine working steam with the reverse lever in the corner may produce the same high pressure. Thus

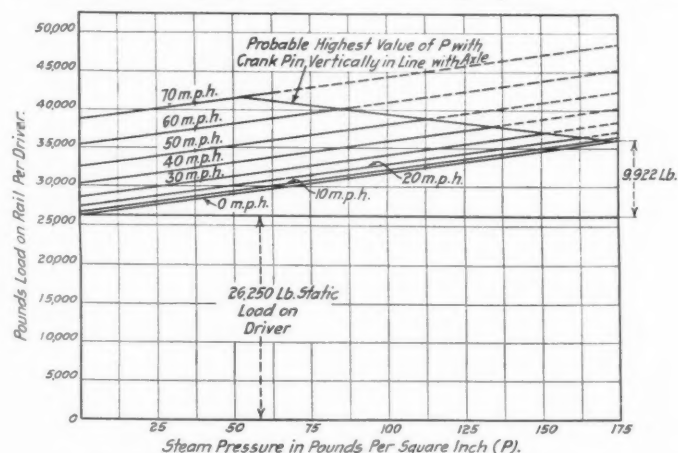
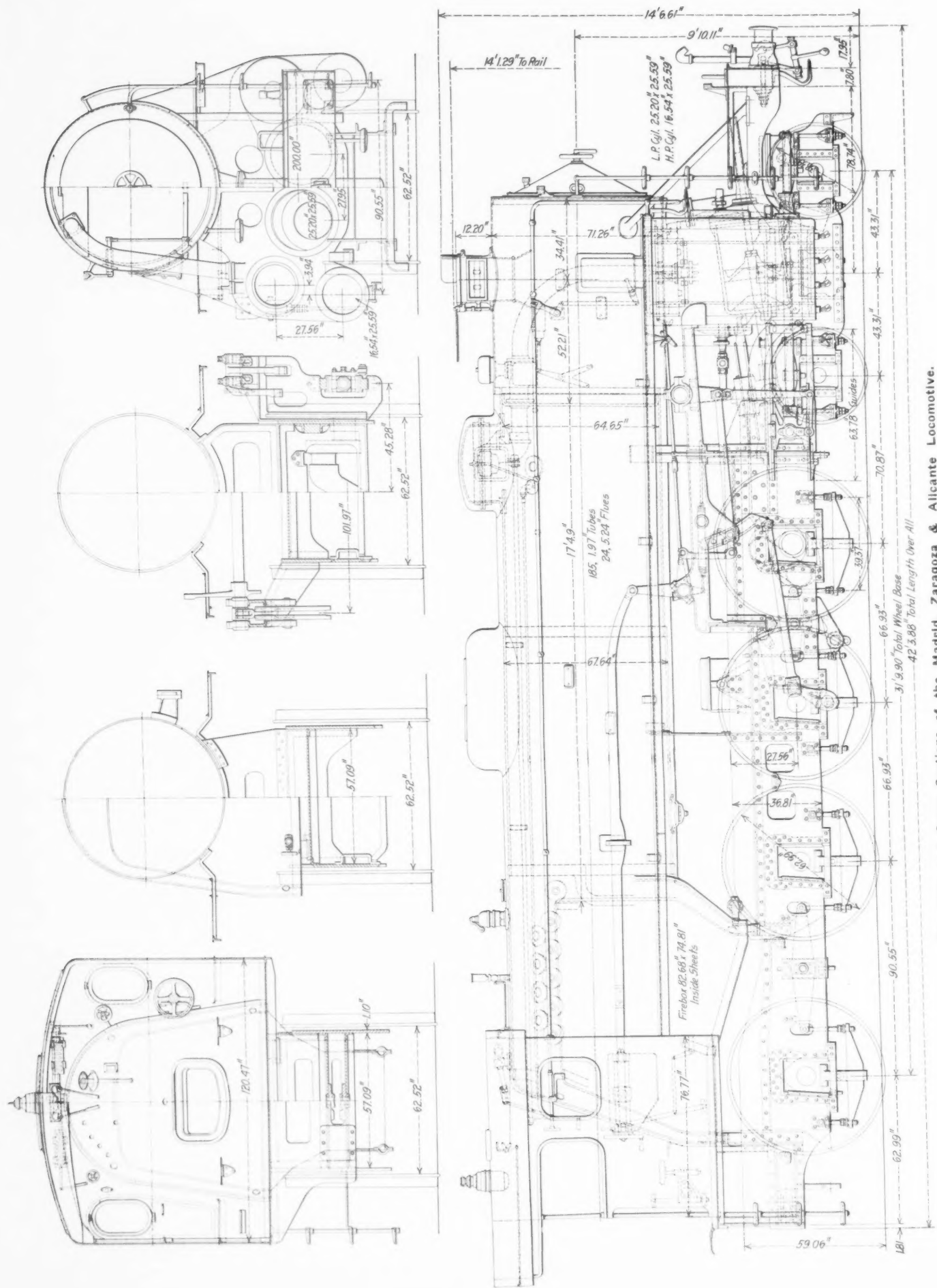


Fig. 3—Total Rail Thrust of Main Driver for Various Speeds

practically every locomotive that passes over a rail gives rise to stresses that are usually thought to be induced only by high speed passenger trains. One point of contrast between the vertical force from the counterbalance and that from the main rod is that the counterbalance increases the rail pressure only during one-half of a revolution of the drivers and decreases it during the other half whereas the main rod increases the pressure at all positions of the crank pin. It is well known that there are many factors which influence rail pressure that are beyond exact computation, but the greater the number of unknowns that are eliminated and the more closely that condition is approached wherein the actual rail pressure is known, the more intelligent will become the design of rolling equipment and rails.



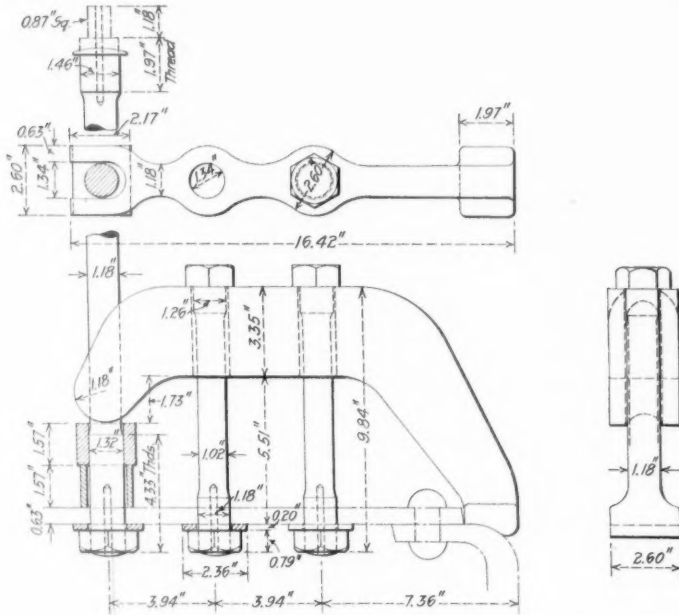


Elevation and Cross Sections of the Madrid, Zaragoza &amp; Alicante Locomotive.

through a spherical center pin bearing which is shown in one of the drawings.

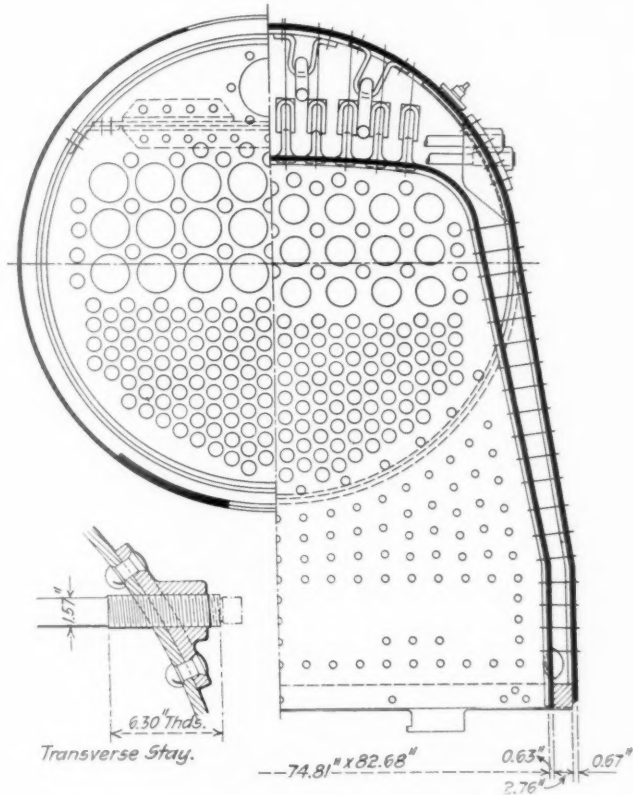
The front end is fitted with a high exhaust pipe, which reaches approximately to the center line of the boiler. The

being of copper. On 19 engines, the water-space stays are of manganese bronze. On the remaining six engines copper stays are applied to the throat and in the lower rows of the sides and back head, manganese bronze being applied in the upper rows. All of the staybolts are drilled entirely through



Longitudinal Crown Bar Expansion Stay

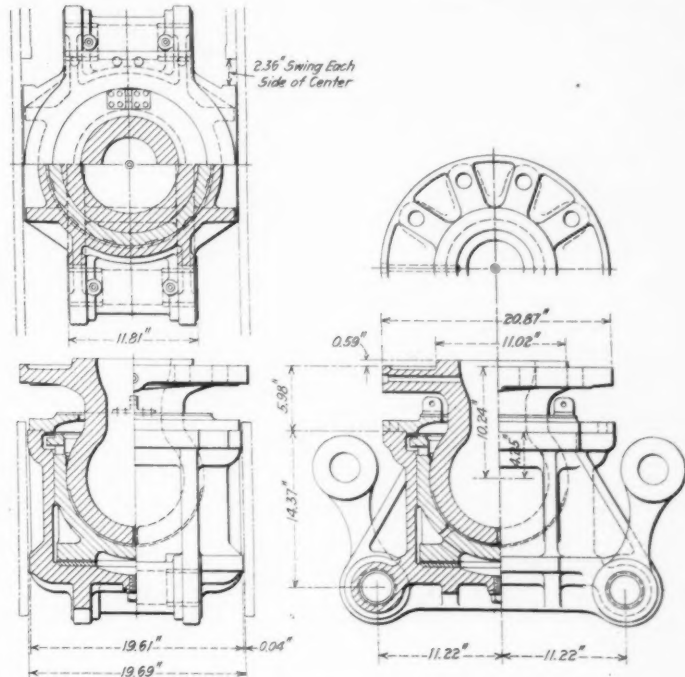
body of the pipe is made up of four sections. It is provided with an adjustable tip which can be lowered into the pipe, thereby increasing the outlet area by opening an annular passage around the tip. The adjustment is made in the cab by



Half-Sections Through the Smoke Box and Firebox

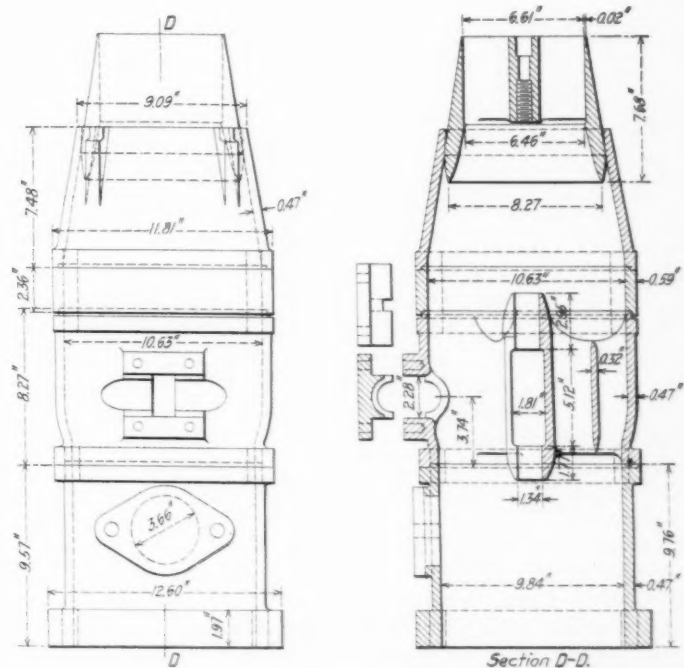
means of a hand wheel and screw. The smoke-stack has a hood for checking the draft when the engine is standing or drifting.

The boiler is of the straight top type, the inside firebox



Details of the Spherical Engine Truck Center Pin Bearing

with a central hole .2 in. in diameter. The holes are stopped on the outside with steel plugs, the inside being left open. Crown bars are used on the first two transverse rows of crown stays. Instead of the transverse bars, which at one time were commonly used in America, the bars are arranged



Exhaust Pipe with Adjustable Tip

longitudinally. Each bar rests on the top of the tube sheet at the front end and carries one bolt in each of the two transverse rows. At its rear end it is supported on a square block which is threaded onto the lower end of the crown

stay in the next row back. A sleeve of 1½-in. pipe is placed between this block and the crown sheet. Part of the load carried by the crown bar bolts is thus transmitted to the first row of through crown stays. The water leg is closed at the door opening with a cast steel door ring to which are riveted the copper door sheet and the steel back head sheet.

The principal dimensions and proportions are as follows:

General Data	
Gage .....	5 ft. 6 in.
Service .....	Passenger
Fuel .....	Bit. coal
Tractive effort, simple .....	35,500 lb.
Tractive effort, compound .....	29,550 lb.
Weight in working order .....	192,900 lb.
Weight on drivers .....	136,900 lb.
Weight on leading truck .....	56,000 lb.
Weight of engine and tender in working order .....	315,900 lb.
Wheel base, driving .....	18 ft. 8½ in.
Wheel base, total .....	31 ft. 9½ in.
Wheel base, engine and tender .....	58 ft. 2½ in.
Ratios	
Weight on drivers ÷ tractive effort, simple .....	3.9
Weight on drivers ÷ tractive effort, compound .....	4.6
Total weight ÷ tractive effort, compound .....	6.5
Tractive effort × diam. drivers ÷ equivalent heating surface* .....	593.3
Equivalent heating surface* ÷ grate area .....	73.1
Firebox heating surface ÷ equivalent heating surface*, per cent. ....	5.1
Weight on drivers ÷ equivalent heating surface* .....	43.5
Total weight ÷ equivalent heating surface* .....	61.3
Volume equivalent simple cylinders .....	9.3 cu. ft.
Equivalent heating surface* ÷ vol. cylinders .....	338.2
Grate area ÷ vol. cylinders .....	4.6
Cylinders	
Kind .....	Compound
Diameter and stroke .....	16.54 in. and 25.2 in. by 25.59 in.
Valves	
Kind .....	Piston
Wheels	
Driving, diameter over tires .....	.63 in.
Driving, thickness of tires .....	.3 in.
Driving journals, front, diameter and length .....	8.86 in. by 9.06 in.
Driving journals, fourth, diameter and length .....	7.87 in. by 9.84 in.
Driving journals, others, diameter and length .....	7.87 in. by 9.06 in.
Engine truck wheels, diameter .....	38¾ in.
Engine truck, journals .....	6.3 in. by 11.81 in.
Boiler	
Style .....	Straight top
Working pressure .....	213.4 lb. per sq. in.
Outside diameter of first ring .....	.66½ in.
Firebox, length and width .....	82¾ in. by 74¾ in.
Firebox plates, thickness .....	crow. sides and back, .63 in.; tube, .63 in. and 1.18 in.
Firebox, water space .....	front and back, 3.54 in.; sides, 2.76 in.
Tubes, number and outside diameter .....	185—1.97 in.
Flues, number and outside diameter .....	24—5.24 in.
Tubes and flues, length .....	17 ft. 4.9 in.
Heating surface, tubes and flues .....	2,233.5 sq. ft.
Heating surface, firebox .....	161.5 sq. ft.
Heating surface, total .....	2,395.0 sq. ft.
Superheater heating surface .....	500.0 sq. ft.
Equivalent heating surface* .....	3,145.0 sq. ft.
Grate area .....	43 sq. ft.
Tender	
Tank .....	Water bottom
Frame .....	Channel
Wheels, diameter .....	38¾ in.
Journals, diameter and length .....	5.12 in. by 10.04 in.
Water capacity .....	6,600 gal.
Coal capacity .....	6½ tons

\*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

## ELECTRIC LOCOMOTIVE OPERATION

At the March meeting of the New York Railroad Club, C. H. Quinn, chief electrical engineer of the Norfolk & Western, gave a few facts relative to the performance of electric locomotives in contrast to steam locomotives on that road. The electrified portion of the Norfolk & Western extends from Bluefield, W. Va., to Vivian, a distance of about 30 miles. The grades on the line are heavy, varying from one per cent at the west end, to one and a half and two per cent about ten miles from the west end.

When electric operation was started in January, 1914, the speed of the tonnage trains up the grade was increased from 7 to 14 m.p.h. The traffic through the Elkhorn tunnel, which is at the top of the grade above mentioned, was greatly expedited. This tunnel is about 2½ miles long. It has been found that the electrically handled coal trains can keep out of the way of any steam movements in the same direction on the grade with the exception of two through passenger trains. Further than this the absence of delays incident to the taking on of coal and water for three steam locomotives which were

previously required to handle the trains has not only materially reduced the running time, but has cut out delays to other trains.

The trains handled by electric locomotives are braked by what is called the regenerative braking system. This means that the motors of the electric locomotives are transformed into dynamos, thus absorbing the power given up by the heavy train while descending the grade and generating it into electricity, pumping it back into the line. This has practically eliminated the use of the air brake for governing train movements down the grade. The elimination of broken knuckles, trains breaking in two and other incidental delays due to difficulties with the air brake equipment on long trains, are some of the benefits obtained by regenerative braking.

The improvement in the movement of coal tonnage trains has resulted in a marked reduction in the time required to get these trains over the road. Under steam operation, the average miles per day would approximate 60 per locomotive. This mileage, with the electric locomotive, has been increased to 100, with only a slight increase in time in service per day for the engine crew. The short terminal layover for the electric locomotives, which averages 45 minutes per locomotive, practically permits double crewing these locomotives every 24 hours. As a direct result, the number of locomotives handled out of Bluefield has been reduced from 17 steam to 5 electrics. The number of pusher engines has been reduced from 7 steam locomotives to 2 electric locomotives.

Electric locomotives during zero weather operate at practically full tonnage rating, while the steam engine always requires a tonnage reduction in cold weather. Further than this, the terminal attention and terminal equipment required for the electric locomotive is conspicuously less than that needed to take care of steam power.

The maximum eastbound tonnage for any 24-hour day handled by steam locomotives amounted to 51,226 gross tons; by electric locomotives, 59,543 gross tons, or an increase of 16 per cent. The maximum number of loaded eastbound cars per day handled under steam operation amounted to 675; with electric locomotives, 757 cars. The maximum number of locomotives in use to handle the heaviest day under steam operation was 43; with electric operation, 9. The total number of loaded cars handled eastbound during the year 1914, under steam operation, amounted to 132,618, while in 1916, with electric operation, the number was 165,689, an increase of 33,071. This shows a 25 per cent increase.

To handle the business with steam locomotives during the year 1914, as covered by the above figures, required a total of 93,625 engine-hours. To handle 25 per cent more traffic in 1916 with electric locomotives required a total of 44,112 engine-hours, a reduction of 48 per cent.

The field of activity of the electric locomotives should naturally be confined to sections of the road where the profile and tonnage handled will permit the economical use of this type of motive power. There are other sections of the road where the maximum possibilities of the steam locomotive have not as yet been reached, and where they are still able to be operated as economically as compared with the returns from an investment which would be represented by the use of the electric locomotive. With the commercial value of the steam locomotive well understood under such conditions, the next development in this direction will probably be the design and building of a Mallet locomotive with a tractive effort of approximately 104,000 lb. for use in main line service over 100-mile divisions of the road.

The use of electric locomotives in congested sections of the railroad, for the movement of heavy tonnage over grades requiring pusher service, is here to stay, and its extended use in this class of service will be general in the not very distant future.

## MOUNT UNION COLLISION

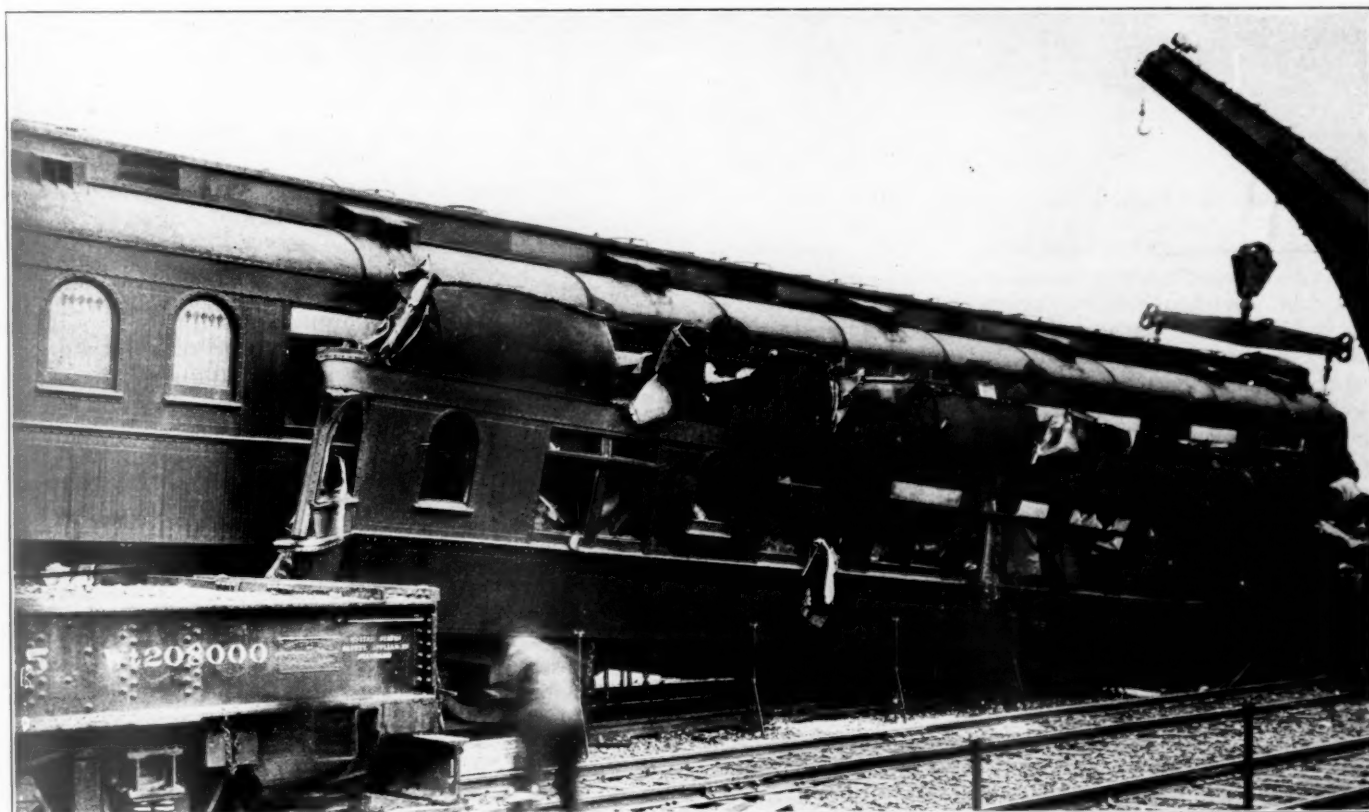
A rear collision of eastbound trains on the Pennsylvania Railroad at Mount Union, Pa., occurred on the morning of February 27. A passenger train standing at the station was run into by a fast freight, consisting of a consolidation engine, Class H 9s, weighing 251,000 lb., thirty-five cars and a caboose.

The behavior of the steel cars in the passenger train is indicated by the illustration. It is remarkable that greater damage was not done. The weight of the freight train was estimated to be about 1,000 tons and its speed at about 40 m. p. h. when it struck the passenger train, which was standing on a tangent. The underframe of the rear car of the passenger train, the Bellwood, was wedged in between the front frame and the smokebox of the engine of the freight train, butting against the cylinder saddle. The rear end of the Bellwood seems thus to have been raised sufficiently to allow the front end of its underframe to pass underneath that of the car ahead of it, the Bruceville. This permitted the underframe of the Bruceville to split open the superstructure

## PULVERIZED COAL PLANT FOR THE SANTA FE

Preparatory to testing the value of powdered coal as a locomotive fuel, the Atchison, Topeka & Santa Fe has had built at Marceline, Mo., by the Fuller Engineering Company, Allentown, Pa., a complete plant for pulverizing and drying the coal. Test runs are to be made in freight service between Marceline and Shopton, Iowa, a distance of 113 miles. A similar plant is to be erected at the latter point. Two Mikado locomotives are to be used for burning the pulverized fuel, one of which has been equipped with the apparatus of the Fuller Engineering Company, and the other is to be equipped with the apparatus of the Locomotive Pulverized Fuel Company. These locomotives have a total weight of 283,700 lb., 25-in. by 32-in. cylinders, a total heating surface of 4,111 sq. ft., a superheating surface of 880 sq. ft., making a total equivalent heating surface of 5,431 sq. ft. They operate at 200 lb. boiler pressure, and have a rated tractive effort of 59,600 lb.

An interior and exterior view of the pulverizing plant is



The Rear Car, Split Open and Telescoped by the Car Ahead

of the Bellwood, causing the death of 20 persons. There were no persons injured in the Bruceville and the damage to the superstructure of the car was slight, but few windows being broken. The whole train of eight steel cars and one engine was pushed forward about 200 ft.

The locomotive of the freight train was but slightly injured. The front end was crushed in and the cylinder saddle punctured by the underframe of the Bellwood. Only one pair of drivers left the rails. The tender and the first two freight cars buckled and were derailed. The freight cars were completely demolished and fell down the embankment at the side of the track. The tender cistern broke loose from its frame and rolled down the embankment also. Needless to say, had the passenger cars been of the old wooden construction, far greater damage and loss of life would have occurred.

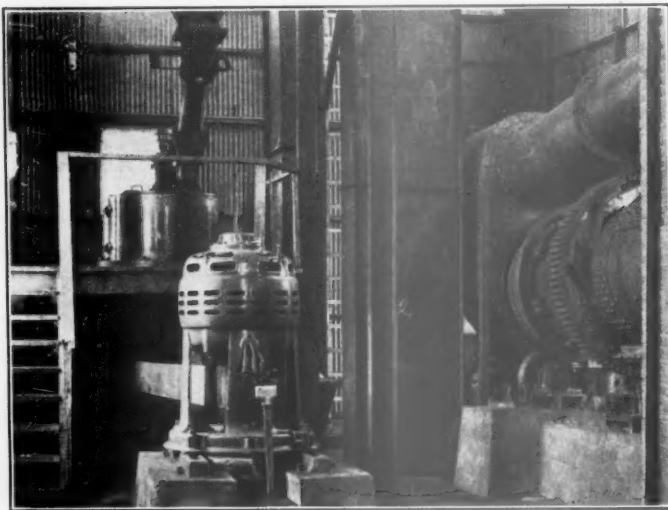
shown in the illustrations. The capacity of this plant is dependent upon the output of the pulverizer, which is from  $1\frac{3}{4}$  to  $2\frac{1}{2}$  tons per hour. The coal used is Marceline screenings, which consists of 4.8 per cent moisture, 35.6 per cent volatile, 44.6 per cent fixed carbon, and 15 per cent ash. The coal is brought in from the mines and unloaded directly from the cars into a receiving hopper so arranged that it will feed directly into an elevator. This elevator discharges the coal into a storage bin having  $11\frac{1}{2}$  tons capacity. This is located above the coal dryer. A cradle or shaking type feeder is attached to the bottom of this bin to give a uniform supply of coal to the dryer. This dryer is shown at the left of the interior view. It consists of an inclined shell fitted with two tires mounted on rollers, and is driven by means of gearing. It is  $3\frac{1}{2}$  ft. in diameter and 42 ft. long, being fitted with the necessary stack mounted on a brick housing at the feed

end. The coal is fed in at the upper end and by the rotating action of the drier it is gradually carried through the shell to the discharge end. Surrounding part of the drier shell is a large brick housing equipped with grates. The gases of combustion surround the shell and pass down through a smoke connection to the housing at the front end of the drier where these gases are reversed and passed through inside of the drier shell carrying off the liberated moisture. At the discharge end of the drier, in the spout leading down to an



Santa Fe Pulverized Coal Plant at Marceline, Mo.

elevator, is located a Cutler Hammer lifting magnet for the purpose of removing any tramp iron which may be in the coal. After being dried, the coal is elevated and discharged into a bin directly above a 33-in. Fuller-Lehigh pulverizing mill of 14 tons capacity. This machine reduces the coal in one operation so that 85 per cent of it will pass through a 200 mesh sieve. Fine pulverization is very essential for the successful burning of any coal and means rapid and perfect combustion. From this pulverizer the coal is raised by an



Interior View of the Santa Fe Pulverized Coal Plant

elevator and discharged into a screw conveyor which carries it to a 20-ton pulverized coal storage bin located over the center of the track and arranged for feeding the pulverized coal to the locomotive tender.

The building in which this equipment is installed is of steel frame construction covered with corrugated iron siding and roofing. The installation is an experimental one and some minor details are arranged for only temporary use, as it is intended later to move this plant to some other location.

The entire equipment is electrically driven throughout, the current being furnished from a power house located in Marceline, and each unit is driven by an individual motor, alternating current being used. With the exception of the mill the entire equipment is driven by means of back geared motors eliminating all but one small countershaft and making the installation a safe one from an operating standpoint. A preliminary crusher is usually installed in connection with a plant of this kind, but no crusher was included in this case, as the coal received is screened to pass through a one-inch ring. In a permanent installation the crusher is necessary as the coal received will be of various sizes and grades. One miller and one laborer only are required for operating this plant during one shift. The power required by the entire plant is about 17 hp. hrs., per ton of coal handled.

### HEARING ON SAFETY APPLIANCES

The Interstate Commerce Commission held a hearing at Washington on March 1 on the application of the railroads for a further extension of time of one year from July 1, 1917, within which to complete the equipment of their cars with safety appliances in accordance with the order of the commission of March, 1911, and the law of 1910. The commission had allowed the railroads five years within which to equip their cars and later granted another extension of one year until July 1, 1916.

A. W. Thompson, vice-president of the Baltimore & Ohio, appeared on behalf of the executive committee of the American Railway Association and told the commission that on January 1, 1917, out of 2,519,832 cars 296,033, or 11.7 per cent, were not completely equipped to comply with the law. Mr. Thompson said that the abnormal amount of traffic handled by the railways during the past year has greatly increased the difficulty of equipping the cars, because the mechanical forces have been busy in keeping up the necessary running repairs. Other railroad men testified also.

The various witnesses were cross-examined at length by W. G. Lee, president of the Brotherhood of Railroad Trainmen, W. S. Stone, grand chief of the Brotherhood of Locomotive Engineers, and L. E. Sheppard, acting president of the Order of Railway Conductors, who strongly opposed the idea of any extension in time and insisted that many of the cars could be equipped without difficulty and without taking them into the shops.

H. W. Belnap, chief of the Division of Safety, testified at the request of the commission. He said he had repeatedly called attention in his annual reports to the need of special diligence on the part of the railroads in getting their cars equipped, but that they had been slow about getting started with the work. He said that during the first six months only 37,000 cars were equipped. In each succeeding six months the number had increased until recently; if the railroads had done as well during the first years as during the last three years, he said, the work would now be completed. He thought that if the railroads had to do it they would succeed in getting a large percentage of their cars equipped, but that it would be necessary first to issue orders that no cars would be received from owning lines until properly equipped and later to issue another order that no car would be received in interchange until properly equipped and that some plan should be worked out by which the work could be done by foreign lines without returning the car home for repairs. He saw no reason why it was necessary for the roads to have this work done at their own shops, saying it could be done just as well in other shops and billed against the owning road, but that some roads had refused to equip cars with safety appliances for other roads. He thought that some roads had not been diligent in equipping their cars and that many could bring a large percentage of their cars into compliance with the order within 30 days.

# Car Department

## TRAIN LINE MAINTENANCE\*

BY A. McCOWAN

Supervisor Car Work, Canadian Northern, Winnipeg, Man.

The report of the Division of Safety of the Interstate Commerce Commission for the fiscal year ending June 30, 1916, stated that there were 908,566 freight cars inspected, of which 3.72 per cent were found defective; and 27,220 passenger cars, of which 1.82 per cent were found defective. The defects which were found by the inspectors were given in detail in tabular form, and those directly chargeable to the air brake numbered 18,696, which was far above those chargeable to any other part of the car, the next smaller item being couplers and parts.

The number of defects per thousand cars inspected was 45.06. Of this number, 20.58 defects were chargeable to visible parts of air brakes; the next smaller percentage being for couplers and parts, which is 6.09. The remaining 18.39 defects are chargeable to hand brakes, ladders, steps, hand holds, height of couplers, uncoupling mechanism and running boards.

While the proportion of air brake defects as shown in the report, which may be classed as train line defects, is comparatively small, it does not show the relative importance of train line defects, because of necessity we have to watch this matter closely and replace most defective hose or broken train pipes immediately. As a result they are seldom discovered by Interstate Commerce Commission inspectors. In attacking this problem, therefore, we should not only attempt to cut down the percentage of cars which the Interstate Commerce Commission safety appliance inspectors find with defective air brakes, but decrease the material and labor in all repairs and renewals.

I have gone into the life of the air hose with the idea that there is a chance of decreasing very materially the number of hose necessary for renewals, and thereby the cost of renewals. The average life of the hose is considered about eight months for air hose and one season for steam hose. In Western Canada we find that the average life of a steam hose is a little over four months. While this may be looked upon as a season in certain parts of the United States, it cannot be so considered in the north.

The Railway Age Gazette stated in an editorial in 1912 that the average life of hose a couple of years previously was only eight months, and that at that time, the life of hose was probably less because the quality of hose was lower, and that the railways buy poor hose because mechanical injury destroys it in a few months, whether it is good or bad. It is the opinion of those familiar with the hose question that a hose should last three years if not subjected to mechanical injury. Since it seems that the average life is only eight months there is a chance for increasing the life of hose two years and four months; in other words, making it last  $4\frac{1}{2}$  times as long. The interesting question now is to see what this means in dollars and cents.

In the United States there were in 1915 in service 2,370,532 freight cars, 55,810 passenger cars, 98,752 company service cars—a total of 2,525,094 cars; and 66,229 locomotives.

\*Abstract of a paper read before the Car Foreman's Association of Chicago.

This means that there were in use 4,741,064 hose on freight cars, 111,620 on passenger cars, 197,504 on company service cars and 66,229 on locomotives, or a total of 5,116,417 hose. This does not include hose on the front ends of locomotives or between engines and tenders.

The renewals of these 5,116,417 hose, with a life of eight months, would be at the rate of 7,674,626 per year; while if the life were three years, they would be at the rate of only 1,705,472 per year. This is the saving at which we should aim in the use of materials only. There are many other things which, in the aggregate, probably represent even a larger amount of money: viz., the labor of applying and taking off, the cost chargeable to train delays caused by hose or train pipes bursting in transit, capital account tied up in material, etc.

Hose costs from 30 cents to 60 cents or more per foot. Increasing the life of the hose from eight months to 36 months will make a saving in renewals of 5,969,154 air hose per year, which at 55 cents each (the cost of 22-in. hose) is equal to \$3,293,000.

It is claimed that loose or broken train pipes are even more prevalent than defects in hose, and this is borne out by the statistics of the Interstate Commerce Commission. The train line often breaks just back of the angle cock when cars are pulled apart without uncoupling the hose.

What causes all these defects in the train pipe and decreases so greatly the life of the hose?

An inspection of the scrap hose pile will show very plainly that most of the defects in hose are at the nipple end. This is where the great majority of hose fail. The train pipe usually breaks just back of the angle cock. These facts point plainly to the jerking apart of the cars while the hose are coupled, as the main cause. I do not mean to say, however, that pulling the cars apart is entirely responsible for defects at the nipple end of the hose. When a hose is not coupled up and a car is switched around the yard, the hose is swinging constantly and all the strain comes on the nipple end.

The strain on the hose when cars are pulled apart without uncoupling the hose, with train line fully charged, is said to be 500 lb. This not only causes rupture of the hose at the nipple end, but it weakens the fabric throughout the entire length. This stretching is responsible for more hose failures than bending at the angle cock. In a test of 22,000 pieces of air hose referred to in the Railway Age Gazette for February 14, 1913, page 275, 82 per cent were found to be porous, and the porosity was not localized but extended all along the hose. The porosity of the hose is often charged up to poor material when, as a matter of fact, it is really caused by jerking apart.

We are accustomed to assume that tonnage reduction in the winter is necessary because of slippery rails, greater radiation of heat, poor lubrication, etc. Investigations on one road have shown that a great deal of this tonnage reduction is necessitated because of leaks in the train line, the impossibility of providing enough air to operate the brakes on long trains. This subject of leakage is a very important one, not only because of its effect on the tonnage that may be hauled and the amount of fuel consumed, but also because

of its effect on the operation of the air pump and delays which are caused by brakes sticking.

Train line leaks may be classified under the following heads:

- Leaks at the hose coupling.
- Leaks in the hose itself.
- Leaks where the hose connects with the coupling.
- Leaks where the hose is attached to the train pipe.

Leaks in the coupling proper are usually chargeable to the wear and tear of the materials and gaskets, or to the coupling being poorly made by the brakemen or carmen. Leakage is also caused here by snow, frost and ice. Further, when an air hose freezes it often becomes so stiff that it will not bend. This causes the joint between the two hose to leak whenever there is any movement between the couplings, and also causes leaks where the hose is attached to the train pipe, the hose often being pulled loose at this point.

The difficulties encountered and time consumed in coupling and uncoupling hose in winter weather are considerable. Even at zero weather the hose becomes so hard as to lose all flexibility, and during coupling and uncoupling it is necessary to bend the hose, which usually cracks the rubber, making it porous. A hammer is commonly used for hitting the hose couplings to make them lock. This tends to jar the hose fitting out of place in the frozen bag at the nipple and coupling sleeve, causing a leak when the train is in motion, especially when rounding curves. The hammering on hose couplings also damages them to such an extent that it is necessary to remove the hose because the gaskets do not fit properly. This same trouble is experienced on the road because the couplings are drawn up by the frozen hose on curves, causing the brakes to creep on and making it necessary for the trainmen to hammer the couplings down in place. Another difficulty is that all angle cocks are not in proper position to allow the hose couplings to meet in line. The hose is twisted before the couplings can be made to lock and in case they are pulled apart very often they do not unlock, breaking the hose or the train pipe.

The time ordinarily consumed in coupling and uncoupling hose on a forty-car freight train under ordinary conditions at the different winter temperatures is as follows:

Temperature	One man uncoupling	One man coupling
Zero	45 min.	50 min.
5 to 10 deg. below	50 min.	55 min.
15 to 20 deg. below	55 min.	60 min.
25 to 30 deg. below	65 min.	70 min.
35 to 40 deg. below	70 min.	75 min.

The time in the last column allows only for coupling the hose. Any extra time required for changing hose, gaskets, etc., depends entirely on conditions. This ordinarily takes 15 to 20 min., sometimes it takes an hour.

The amount of both yard and road detention chargeable to train-line trouble, not to say anything of car and freight delays, is worthy of consideration. One and one-half hours over each engine division is considered a good average of road detention to each freight train handled under northern winter conditions, caused mainly through hose trouble, creeping on of brakes and extra time taken for pumping up in releasing. Along with this come flat and shelled wheels from creeping brakes; there is also excessive strain on the draft rigging. A broken train line means the cutting out of the car, and not infrequently twenty-four hours' delay to it in getting repairs made.

The defects which develop because of the present hose connections between cars, as well as safety considerations and convenience, early led inventors to the consideration of an automatic connector. Quite a few connectors have been developed to the point of trial, but until very recently none has had an extensive installation.

We are using an automatic connector on the Canadian Northern in both freight and passenger service and have 207 cars equipped. The first installation was made June 6, 1914, so that we have had 32 months' experience with the con-

nectors. The connectof which we are using is the Robinson and it has also been installed on a large number of Canadian Pacific passenger cars.

You will realize that in the northern country where the climate is sometimes very severe, we have greater need for a connector than railroads operating in the south. It requires a good deal more steam to heat our cars, and the results of leakage are magnified. Our trains are harder to move after they have stood for a short time because the lubricating oils harden, and for this reason we have to cut down unnecessary stops or delays to a minimum. The makers of this connector are so confident of the life of hose which the connector makes possible that they guarantee a life of three years for air hose used with it.

On the question of leakage I have only to quote from one of the reports which has been given on the connector:

"During the intensely cold weather of December and January, when temperatures sometimes in excess of 40 deg. below zero were recorded in certain parts of Canada where these cars were in operation, no trouble was experienced from leakage in connection with the device, although at the same time it was found impossible to prevent very serious leakage in ordinary hose \* \* \*

"To one familiar with yard and train service, there appears to be no room for argument about the need of such a device. The greater life of hose, the absence of broken train pipes resulting from uncoupling cars without first disconnecting the hose, the saving of time and labor in making up trains, and the reduction in the cost of pumping air, all of which might be classed as direct or apparent economies, would undoubtedly justify the cost of application alone, but the writer is even more impressed with the benefits that would be secured indirectly. Numerous leaks are found in hose and gaskets at all seasons of the year, almost entirely the result of the practice referred to above: viz., pulling the hose apart, thereby injuring the fabric and inner tube. In very cold weather, however, when the hose freezes, the difficulty in preventing air leakage becomes a controlling factor in the operation of long freight trains and they have to be reduced in length to a point where the air pressure can be maintained irrespective of the tonnage ratings or the ability of locomotives to haul them. Even at the best, this factor is responsible for a very great amount of terminal detention and labor on the part of car men trying to stop leaks."

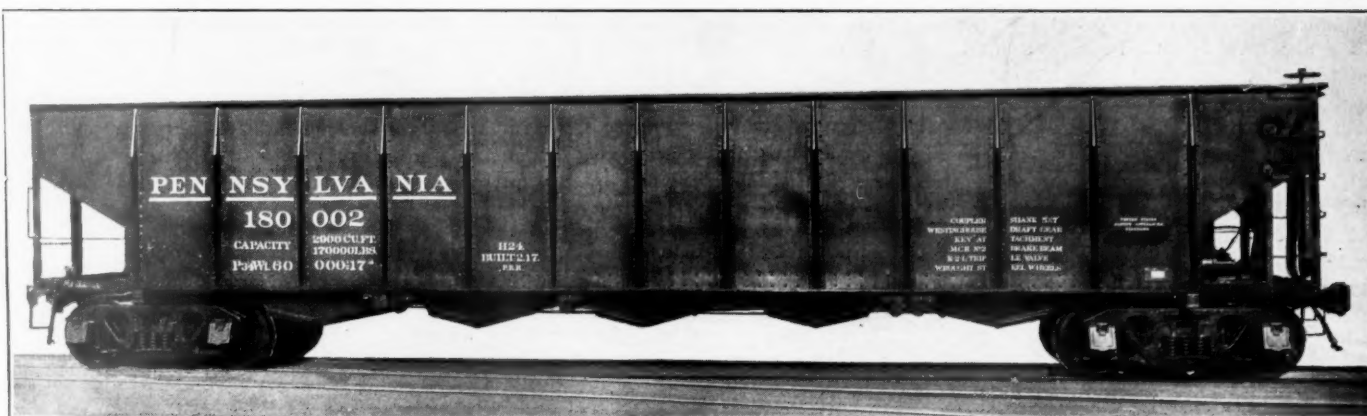
The connector increases the life of hose because it eliminates all mechanical wear. The hose is never jerked or strained. Frozen hose does not interfere with its operation and leakage and breaks are cut down.

We have found on the Canadian Northern that the Robinson connector saves us a lot of money. We estimate the comparative cost about as follows:

Cost of present equipment.....	\$23.90
Cost of Robinson equipment.....	36.95
Difference .....	\$13.05
Cost of maintenance of present equipment for three years..	\$45.05
For Robinson equipment.....	37.49
The saving in three years is.....	\$ 7.56

For six years the cost of maintenance of present equipment is \$90.10, while for the Robinson connector it is \$47.80, including the interest on the difference in cost between the two systems. This means a saving in six years of \$42.30 made possible with the connector.

I have made no mention of signal hose and but little mention of steam hose. If these were both taken into consideration the estimated saving of \$3,293,000 resulting from the increased life of hose, would be very materially increased. The economy in hose and train pipe breakage, however, sinks into significance when compared with the immense amount which would be saved in eliminating train delays and reducing trainmen's wages and coal consumption by the use of the automatic connector.



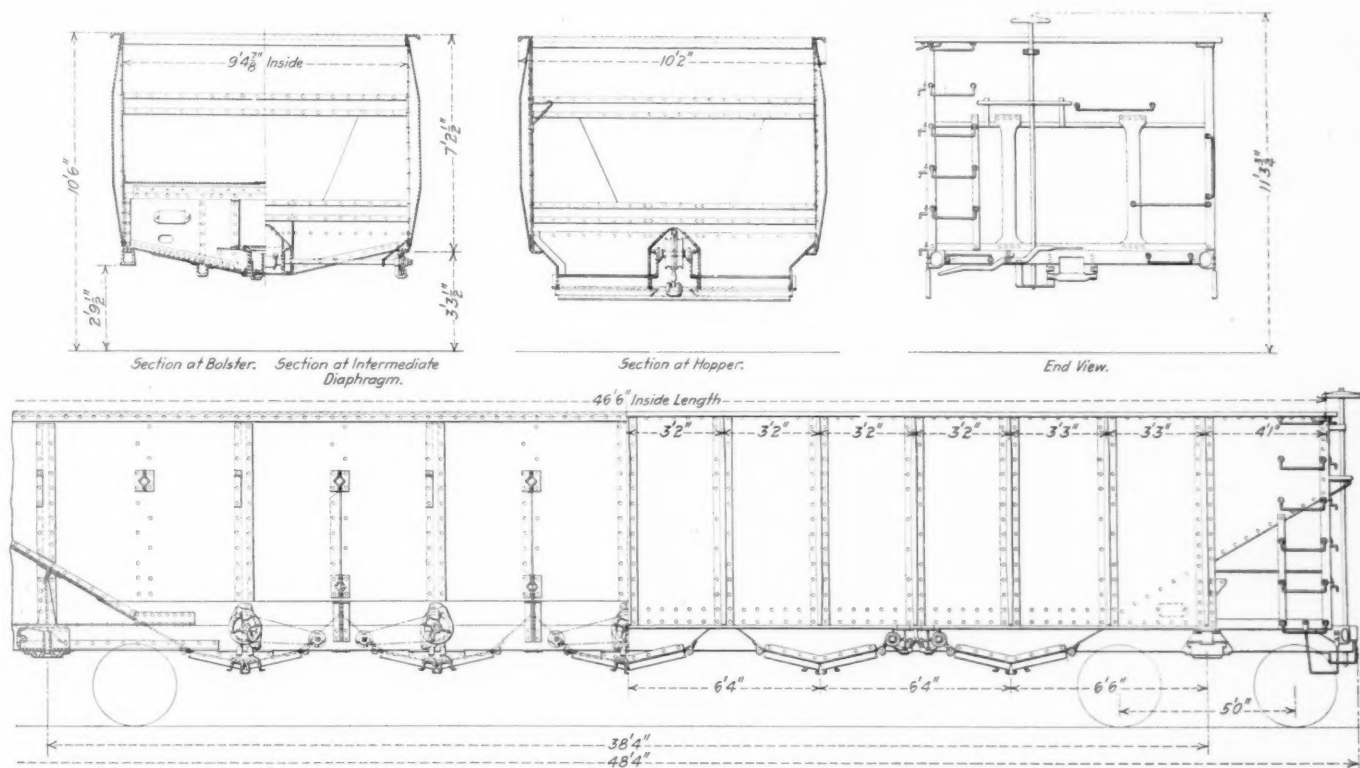
## PENNSYLVANIA 85-TON HOPPER CARS

An All-Steel Coal Car Having a Light Weight of 60,000 Lb. and 3,228 Cu. Ft. Gross Cubical Capacity

THE Pennsylvania Railroad has gone one step further in the construction of its all-steel hopper cars and is building, at its Altoona shops, a car which has a capacity of 170,000 lb. and a light weight of 60,000 lb. The new design is known as the Class H-24 car and is patterned after the Pennsylvania Class H-21a hopper car,

load. The general dimensions of the car are as follows:

Light weight .....	60,000 lb.
Length over end sills .....	48 ft. 4 in.
Length inside .....	46 ft. 6 in.
Distance, from center to center of truck .....	38 ft. 4 in.
Width, extreme .....	10 ft. 2 in.
Width, inside .....	9 ft. 4 in.
Extreme height from rail .....	10 ft. 6 in.



Elevation and Sections of 85-Ton Hopper Car for the Pennsylvania

the details of which are interchangeable. In the new car the cubical capacity has been increased to 3,228 cu. ft. This large amount has been obtained by the addition of a bay 6 ft. 4 in. long thus requiring five hoppers instead of four, which is the number now being used in the Class H-21a equipment.

The top and bottom members of the sides of the new equipment have been increased 50 per cent in sectional area over that of the old equipment, to take care of the

Truck wheel base .....	5 ft. 10 in.
Truck weight .....	13,050 lb.
Capacity .....	170,000 lb.
Cubical capacity:	
Level with the top .....	2,900 cu. ft.
Contents heaped .....	328 cu. ft.
Total .....	3,228 cu. ft.

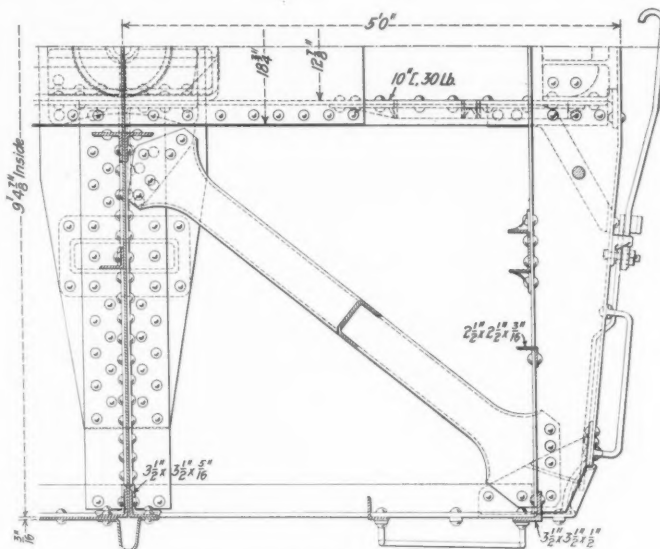
**Underframe.**—The underframe is characteristic of former Pennsylvania designs, having a well-balanced central member to absorb the buffing stresses, while the major portion

of the load is carried by the side construction. The center sills are two 10-in., 30-lb. channels, 48 ft.  $\frac{3}{4}$  in. long, strengthened latterly by spacers at the diaphragms, as well as by cover plates at either end. Cast steel striking plates join the end and center sills. The center sills are further reinforced by two other steel castings, which extend forward and backward a sufficient distance from the center line of the bolster to form a draft gear stop and act as a spacer for the center sills at the point where the body bolster is joined thereto. The center sill cover plate and bottom reinforcing angles are not continuous on account of the clearance required by the drop door operating device. A U-shape ridge sheet, the four sections of which form a continuous member extending between the end slope sheets, is substituted for a continuous cover plate, and is so attached to the center sill that there is at least 24 sq. in. of metal to resist buffing. The bottom member of the side construction is a 4-in. by  $\frac{5}{8}$ -in. angle. The end sills are pressed Z-shape members.

The body bolster is composed of a  $\frac{1}{4}$ -in. vertical web plate, cut out over the center sills to permit them to pass through. It is secured at the top to the end slope sheets by two 5-in. by  $3\frac{1}{2}$ -in. by  $\frac{3}{8}$ -in. angles, 8 ft. 10 in. and 6 ft.  $8\frac{1}{2}$  in. long. It is strengthened at the bottom by two 5-in. by  $3\frac{1}{2}$ -in. by  $\frac{3}{8}$ -in. reinforcing angles, which extend from the center to the side sills. A tie plate passes under the center sills and is riveted to the web plate reinforcing angles on either side, as well as to the center sills, the center sill reinforcing angles and the center sill casting. The center plate is a drop forging.

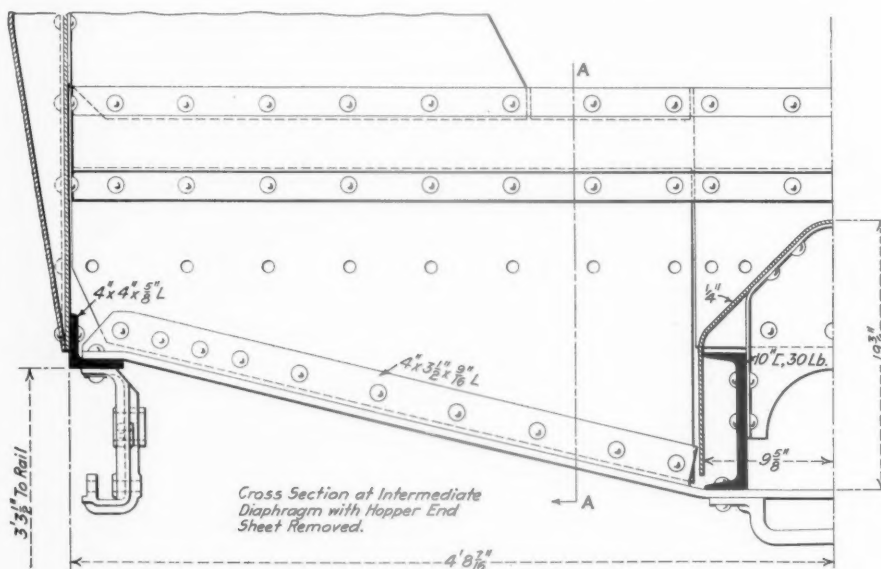
Four intermediate diaphragms located between the five hoppers transfer the major portion of the load from the center to the side construction. The diaphragms, like the bolster, are of the single plate type, which gives the maximum amount of space for the hoppers. The  $\frac{1}{4}$ -in. diaphragm sheet is divided into three parts, one on either side of the center sills and the central portion immediately above, all of which are joined together by the cross ridge sheets and lower cross ties. The bottom of the web plate is reinforced by two

distinct members; viz., a 5-in. 19.3-lb. bulb angle, as the top member; a 4-in. by 4-in. by  $\frac{5}{8}$ -in. angle as the bottom member, previously mentioned as part of the under-frame; twenty-six vertical U-shape posts spaced 3 ft. 2 in. and 3 ft. 3 in. apart, as the details demand, and  $\frac{3}{16}$ -in. side sheets which connect the other three parts. Alternate posts in conjunction with inside butt strips join adjacent



Half Plan of Bolster and End Sill of Pennsylvania Hopper Car

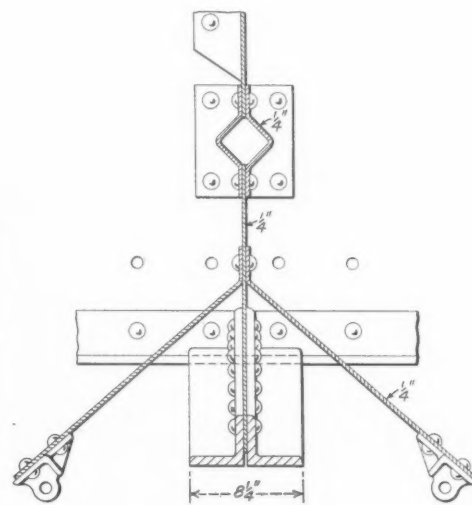
side sheets. The end consists of a  $4\frac{1}{2}$ -in. by 5-in., 19.3 lb. bulb angle at the top, and a  $\frac{3}{16}$ -in. end sheet connected to the sides by the steel corner casting and an angle corner post. The end sheet extends downward 2 ft.  $9\frac{3}{4}$  in. from the top of the bulb angle and is flanged inward at the bottom to support the floor slope sheet. The end floor sheets, ridge sheet and side hopper sheets all slope into the drop



Section Through Intermediate Diaphragm of Hopper Car

4-in. by  $3\frac{1}{2}$ -in. by  $\frac{9}{16}$ -in. angles, the vertical leg of which is cut off at the center sills, allowing the horizontal leg to extend under the sills, thus forming a continuous member from side to side of the car. The top of the intermediate diaphragm web plate terminates between the flanges of a diamond-shaped pressed steel cross brace. Immediately below it are secured the  $\frac{1}{4}$ -in. hopper slope sheets, to the lower edge of which the drop door hinge castings are riveted.

**Superstructure.**—The side construction is composed of four



Section A-A,  
With Side Hopper Sheets Removed.

bottoms at an angle considered sufficient to discharge the load when the doors are open.

Eight diamond-shaped cross braces, two above each intermediate diaphragm, tie the sides of the car together. These cross braces are located one above the other at a distance of 42 in., the center line of the top one being 27 in. below the top of car. A vertical  $\frac{1}{4}$ -in. gusset plate, 18  $\frac{7}{16}$  in. wide at the top and 34 in. wide at the bottom, is riveted between the lower flange of the upper and the upper flange of

the lower cross brace, as well as to the side sheets, thus adding materially to the stiffness of the superstructure. The car has five hoppers which are divided by the ridge sheet which spans the center sills into two units each. Each unit has a pair of drop doors which are operated by a mechanism controlled from the side of the car. When in the release position they have a maximum opening of 3 ft. 5½ in. by 2 ft. 11 3/16 in. per pair of doors.

**Door Operating Mechanism.**—The arrangement of the drop doors and the mechanism for operating them is shown in one of the illustrations. Each door is connected to chain sheaves by two links as shown in section A-A. The door link is attached to the door channel by an adjustable T-bolt which permits the door being adjusted so it will close tightly. The sheave is located directly above the center line of the door opening, between the center sill channels. These sheaves are operated by a chain which passes over the drum shown in section B-B, which is operated by the crank from the side of the car. Ratchet wheels and pawls hold the door in

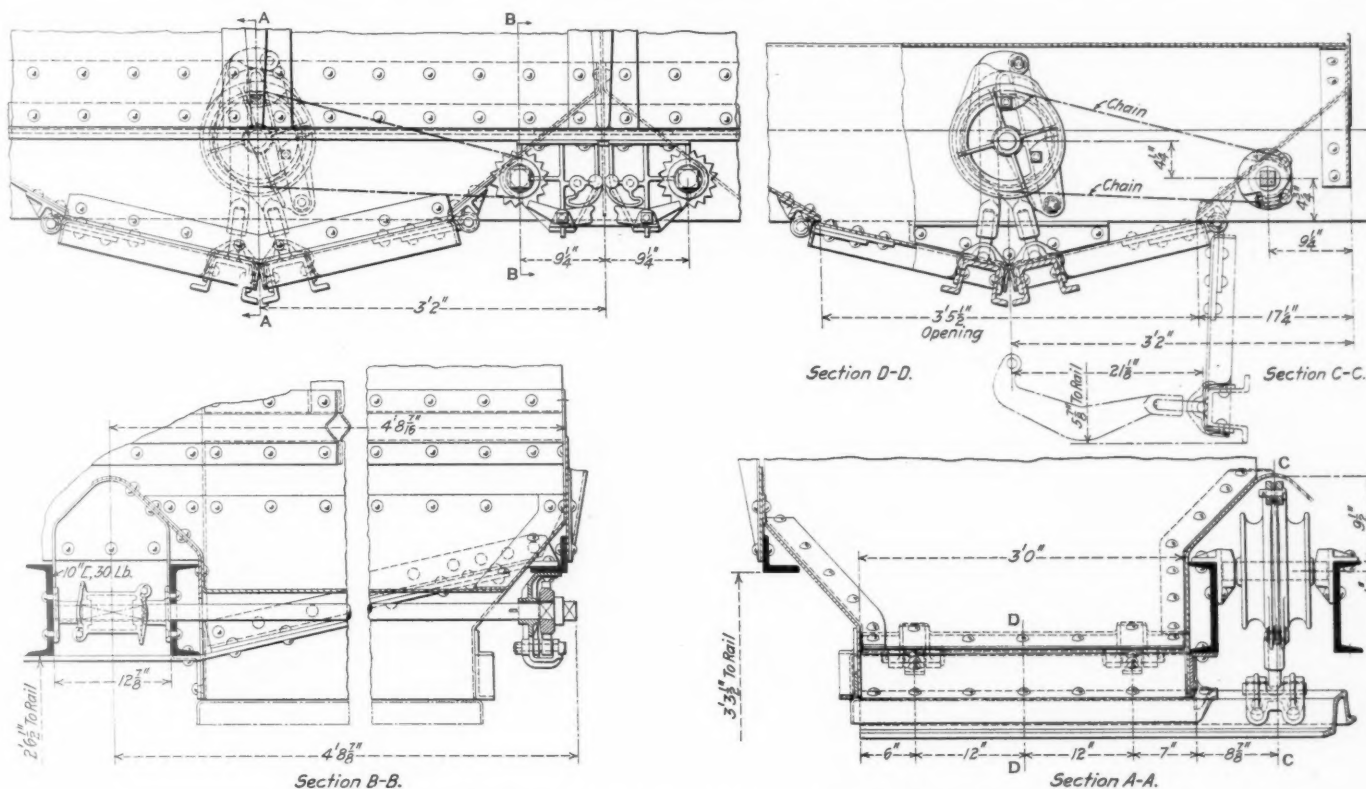
is composed of a 15/16-in. plate with a 3/8-in. cover plate riveted to the top flanges, supporting the drop forged center plate and side bearings. The bolster is 7 ft. 8 in. long, 17½ in. wide and 14¼ in. deep at the center, tapering to 7¼ in. at either end.

## "ONE COAT" PAINT FOR FREIGHT CARS

BY J. H. PITARD

In response to a popular demand for methods of expediting the repairs of freight equipment in the shops, so-called "one coat" paints have appeared in the field and apparently are meeting with favor. Before adopting these paints for general use on freight equipment it is advisable to consider well the degree of protection which they afford and the cost as compared with the usual method.

Some of the "one coat" paints that have come under the writer's observation have proved to be of good quality and make a very creditable showing, but there is still some



Arrangement of Drop Doors for Pennsylvania Hopper Car

any position desired. In the design of the entire arrangement, effort has been made to have it as simple as possible and easily adjusted.

**Trucks.**—The car is carried on two cast steel side frame trucks, having a 5-ft. 10-in. wheelbase, 6½-in. by 12-in. journals, and wrought steel wheels. The side frames are of the box section type in which the brake beam hanger supports and bolster guides are cast integral. The cast steel journal boxes, secured at either end of the side frame with 1½-in. box bolts, are also tied at the bottom by 5/8-in. by 6-in. journal box tie bars, upon which rest two ½-in. shims which may be transferred to the top of the box, thus providing for 1-in. adjustment in the height of the center plate.

The spring plank is a pressed section ½ in. thick and 16 in. wide at the center, being spread at the ends to 20 in. The spring plank supports the third point suspension spring which is located at the center and extends in either direction along the center line of the car a sufficient distance to support the end of the brake beam strut. The bathtub type bolster

doubt as to their value as a protective coating. The thickness of the paint film has much to do with the protection afforded either on wood or metal cars, but more especially on metal, for the reason that linseed oil which is the binder vehicle in all freight car paints, is hygroscopic to some extent; that is to say, it will absorb a certain amount of moisture even when mixed with the pigments. Unless the paint film is of sufficient thickness to prevent the penetration of moisture through to the under surface, the paint will not prevent damage to the car. Effective protection from moisture can only be secured by a thick coating, and it is not possible to obtain the proper degree of thickness with one coat of paint.

In the painting of freight equipment, proper discrimination should be shown in the treatment of metal and wooden cars. Regardless of how naked a wooden car has become, if decay has not set in, it can be effectively protected with paint. The surface of a steel car, however, should not be allowed to become exposed, as rusting when once begun is very difficult to check. It may be stopped temporarily with

thick coatings of paint, but the trouble breaks out again as soon as the paint deteriorates sufficiently to absorb moisture to the depth of the surface of the metal. It seems apparent, therefore, that it will be futile to attempt to maintain a steel car to the end of its natural life with an occasional repainting of "one coat" paint.

It is not the object of this article to disparage the use of "one coat" paints, but rather to assign them to their proper sphere. The "one coat" paint serves as an expedient to furnish protection until the car is brought to the shop again for painting and assists in relieving the congested condition of freight car repair tracks. In view of the fact that these paints generally cost much more than the ordinary freight car paints, the general use of such paints does not seem advisable.

## MAKING A CAR INSPECTOR

BY A. CAMPBELL  
San Francisco, Calif.

Where do the men come from who inspect cars to see that the M. C. B. rules are lived up to? The first duty of the car inspector is to learn to enforce the most important rule of all—"safety first." Many good car men know little of the rules of interchange, but when they O. K. a car or a train you may be sure it is safe to run.

The men who seek positions in the car department reach the railroad yards over many routes and they come there usually for one of two reasons: Visions of adventure may tempt the young, but old or young the compelling reason is in most cases, that they are out of employment and having no regular trade they find here a free and open market for their labor. Out West, at least, most of the men seeking work in this line are what we might call raw recruits. If a man is healthy, and strong enough to make it worth while giving him a trial, the employing officer is usually satisfied. Of course if he has had some experience so much the better, but once in overalls it is largely up to himself how far he will succeed in his new calling.

If the road feels the need, or prefers to make its own inspectors, those in charge will look the new man over to see if he gives promise of future development. He is studied from all sides. What are his habits; is he neat, careful, punctual and energetic; does he write a legible hand and show an inclination to read books or papers helpful to him in his work? These pointers may be picked up in various ways and the foreman will find many opportunities to size up his prospect, often when the man least suspects it.

If the subject looks like a good risk, the way to develop the qualities found is about as follows: Six months on the repair track, three months oiling and about the same time helping the air brake men. Ninety days on air brake work will not make him a finished air brake man, but it will be enough to create an interest in this fascinating branch of the business and will give him an insight into it that will be useful in his after career. Then out in the train yard or on the road, not as inspector but as light repairman or oiler, where the variety of duties will bring him a fund of knowledge that will carry him over the rough places later on. Often he will find himself face to face with problems which, in the solving, will teach him self-reliance and nothing will bring him to favorable notice more quickly than to have it known that he is dependable and can do things well without watching. At this stage he is in close touch with the car inspector's duties. As a kind of understudy, he will learn to know the various classes of cars, their capacity and for what lading they are best suited; there will come a growing familiarity with car wheels and their defects, roofs, doors, siding, couplers and their attachments, trucks, bolsters, side bearings, and so on; he will come to know when a car may safely go forward to its destination, or when it cannot be

safely moved beyond the repair track; he will become familiar with testing air and passing judgment on hot boxes.

All this and much more will be gathered and stored away until the time comes when he will be called upon to say the final word that will hold or send free on its journey the fast freight or loaded passenger train. The successful inspector is the man who, drawing on a multitude of experiences, resolves all doubts in favor of safety. "It may go through to its destination" will not do. A car or a train is either safe to go, or unsafe. All else is chance and the gambler in other people's lives or property is out of place in any position of trust and especially in a railroad yard.

What opportunities for advancement are open to these men? They may be appointed foremen, or with added years of experience may become traveling car inspectors or general foremen. These latter positions, however, call for a more intimate knowledge of the business as a whole than usually comes within reach of the man whose aim at the outset has been limited to the title of car inspector, and beyond this there is little in the records to guide us.

Every car inspector should have a good working knowledge of the M. C. B. rules. The interchange man should be a specialist. They must both be competent to pass on all kinds of loads and also understand the requirements of the safety appliance laws, and everything possible should be done to assist them and make easy the search for the information that will help them in this work.

For the benefit of other branches of the service instruction cars are sent over the road. Would it not be well to have a loading expert with charts or photographs pay an occasional visit to help the car inspector and freight men in this important work? This instruction need not be confined to the placing of lading on open cars but might well cover the disposition of loads in closed cars, and especially should attention be called to the need for protection at door openings, as lack of care in this one particular is fruitful of much trouble and expense. Any car inspector who has worked on outgoing trains or at passing points on the line can readily recall many cases of bulging doors due to the absence of protection. This often means delays in rearranging the load and it frequently starts a good door on the downward path that leads to future damage claims. It will be remembered that this kind of instruction is imparted in a limited but very beneficial way by the Bureau of Explosives, and if the interest aroused by these lectures could be extended to cover a wider field, the claims department work would be lessened to a very large extent.

In this connection it would help to have a supply of large sheets printed and framed, if convenient, showing the various examples in the book, together with the instructions. This constant reminder pasted in car shops, freight sheds and, if possible, in shippers' offices could not fail to arouse interest in this subject and would lead to a very much desired improvement. The books as a rule are scarce and perhaps it would be too expensive to distribute them more widely, but sheets such as I suggest would be a comparatively cheap means of educating the many where the use of the books is restricted to a few.

A final word about the M. C. B. rules. There is room here for an occasional visit from a bright, cheerful instructor or adviser. A well chosen talk from the standpoint of the office man who has to unravel some of the problems arising out of an insufficient knowledge would be well received and be productive of much good.

**FLUX FOR OXY-ACETYLENE WELDING OF CAST IRON.**—In welding cast iron Ferro-silicon sticks should be used as feeders. A suitable flux consisting of 80 parts boracic acid, 20 parts powdered chlorate of potash and 15 parts iron carbide should be applied to the iron after it has been raised to a good red heat.—*Institution of Mechanical Engineers.*

# REINFORCING FREIGHT CAR DRAFT SILLS\*

## Weak Center Sills Analyzed and Methods of Computing the Strength of the Sills and Draft Arms Explained

BY LEWIS K. SILLCOX  
Mechanical Engineer, Illinois Central

FIGS. 1, 2, 3 and 4 concern a single draft sill installation on a 30-ton, 40-ft refrigerator car. The draft sill as shown in Fig. 1 is pulled out and its cross section is shown in Fig. 2. This section has a ratio of stress to end strain of 0.14, the M. C. B. recommendations being that this ratio not exceed 0.06. With a buffing force of 250,000 lb., the fibre stress in this section is 36,000 lb. per sq. in., which is in excess of the elastic limit of the material. By adding a 19-in. by  $\frac{3}{8}$ -in. cover plate to this construction and increasing the thickness of the sill to  $\frac{5}{8}$  in., the weight will be increased 130 per cent, the strength only 33 per cent, the fibre stress will be 24,097 lb. per sq. in. and the ratio of stress to end strain will be 0.06.

Fig. 3 relates to the same proposition, but in this instance the weight has been increased only 10 per cent, with 43 per cent greater strength and a stress to end strain ratio of 0.08. The last solution to this problem is shown in Fig. 4. It has been handled differently here. With additional material amounting to 127 per cent of that provided in the original design, a relative increase in strength of 67 per cent, and

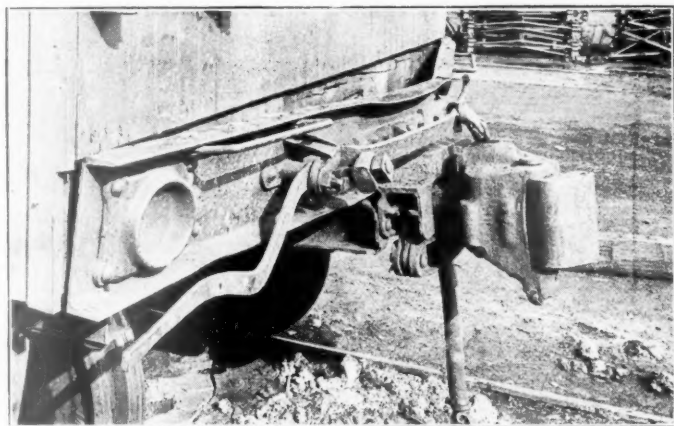


Fig. 1—Weak Draft Sill Pulled Out

a stress to end strain ratio of 0.05 has been obtained. In other words, the material is working at a factor of safety of five and meets the M. C. B. requirements as to ratio of stress to end strain. The method of computing the fibre stress in this section is shown below.

	A	B	AB	D	AD <sup>2</sup>	i	I
Top cover plate—20 in. by $\frac{3}{8}$ in. ....	6.25	11.09	69.31	5.03	158.13	.....	158.18
Top chord angles—3½ in. by 3½ in. by $\frac{3}{8}$ in. ....	4.18	9.95	41.59	3.89	63.24	4.9	68.14
Web plate—10½ in. by $\frac{3}{8}$ in. ....	6.74	5.44	36.67	.62	2.56	68.2	70.76
Web reinforcing plate—10½ in. by $\frac{3}{8}$ in. ....	6.74	5.44	36.67	.62	2.56	68.2	70.76
Web reinforcing plate—2½ in. by $\frac{3}{8}$ in. ....	1.63	10.71	17.46	4.72	36.32	.....	36.32
Bottom chord angles—5 in. by 4 in. by $\frac{3}{8}$ in. ....	10.48	1.12	11.74	4.94	255.71	14.23	269.99
Totals .....	36.02	.....	213.44	19.82	.....	.....	674.10

A = Area.

B = Distance from base of section to center of gravity of each unit.

D = Distance between center of gravity of section and center of gravity of each unit.

\*Taken from a paper presented before the Car Foremen's Association of Chicago.

i = Moment of inertia of each unit about its center of gravity.  
I = Moment of inertia of each unit about the base of the section.  
Height of center of gravity of section above the base =

$$\frac{\text{total AB}}{\text{total A}} = \frac{213.44}{36.02} = 6.06 \text{ in.}$$

$$\text{Section modulus (Sb)} = \frac{674.10}{6.06} = 111$$

$$\text{Fibre Stress (F) in lower flange due to buffing:}$$

$$F = \frac{P}{A} + \frac{P_e}{Sb} = \frac{250,000}{36.02} + \frac{250,000 \times 2.18}{111} = 11,850 \text{ per sq. in.}$$

Where: P = buffing force.  
e = distance between the center of gravity of the section and the center line of draft.

$$\text{M. C. B. Ratio} = \frac{1}{A} + \frac{e}{Sb} = \text{Not to exceed } 0.06$$

$$\frac{1}{36.02} + \frac{2.18}{111} = 0.05$$

Further, if this sill were applied to a box car it would have to take both horizontal (pulling and buffing), and

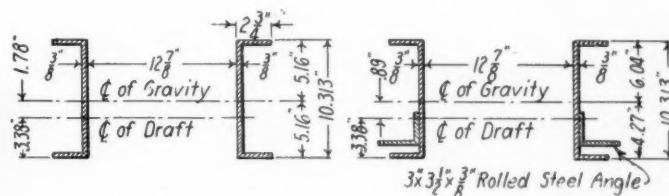


Fig. 2

Fig. 3

vertical (loading in car and dead weight) loading; the former was found to be equal to 11,850 lb. per sq. in., and the latter would amount to approximately 3,800 lb. per sq. in., giving a combined stress of 15,650 lb. per sq. in. As a limit, it might be suggested not to exceed 16,000 lb. per sq. in. under any circumstances. This gives a high working limit in view of the practice on some of the large roads, which use 10,000 or 12,000 lb. per sq. in. as a limit.

A very successful type of center sill construction is shown in Fig. 5. It has been applied to more than 12,000 steel coal cars having an average age of 12 years, and operating in very difficult territory. It has a fibre stress of 6,425 lb. per sq. in. and a stress to end strain ratio of 0.036. It might be mentioned that the sill as shown is only subjected

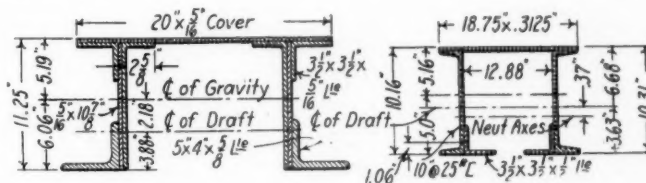


Fig. 4

Fig. 5

to buffing and pulling shocks as the floor plates were located considerably above the draft construction.

### DRAFT ARMS

In the matter of draft arms for freight cars, it might be stated that M. C. B. 1915 Proceedings, page 354, requires that the following condition be conformed to:

Section 6. (a)—The draft attachments, including draft arms, if used, must be of metal, of either integral or riveted construction.

Section 6. (b)—The strength value of the draft attachments and center sill construction must be equivalent to at least 10 sq. in. of steel in tension

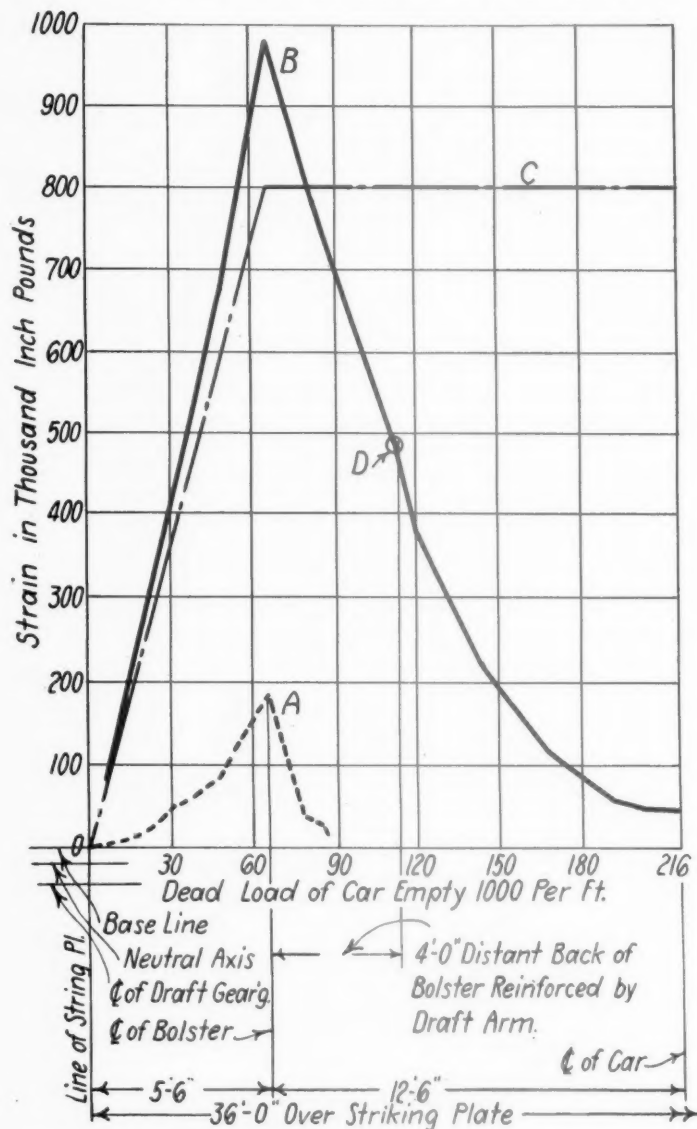
and compression,  $6\frac{1}{4}$  sq. in. of rivet bearing area, and  $12\frac{1}{2}$  sq. in. in shear. The ratio of unit stress to end strain must not exceed 0.15.

Section 6. (c)—Metal draft arms applied to wooden center sills must extend at least 30 in. beyond the center line of the bolster, toward the center of the car, must be securely fastened to the bolster and center sills, and where possible, should butt against compression members placed between the draft arm and needle beams and also between the needle beams.

Hardwood or yellow pine center sills may be considered equivalent to steel in center sill construction between bolsters if they have four times the specified unit values, namely 40 sq. in. tension and compression area, and a ratio of unit stress to end load not exceeding 0.0375.

Section 6. (d)—The draft gear capacity is indirectly governed by the rule 6—(b).

The intensity of end force is assumed to be equivalent to 250,000 lb. static, which may be concentrated on the center line of the draft gear or



- A = Bending moment curve due to dead load of empty car.  
 B = Combined bending moment curve for both impact and dead load of light car.  
 C = Bending moment curve due to impact pressure applied 8 in. below the neutral axis.  
 D = Safe bending moment for car under frame of six 5 in. by 9 in. sills.

Fig. 6—Draft Sill Stress Sheet (Impact Pressure = 100,000 Lb.)

distributed between the draft gear and the end sill. The point of contact between the horn of the coupler and striking plate is assumed to be 2 in. above the top of the coupler shank. For a shank 5 in. deep the distance from the center line of the draft gear to the assumed point of contact of the coupler horn is  $4\frac{1}{2}$  in. The proportion of end force acting on the striking plate is assumed to be 250,000 lb. less  $R$ , which is the resistance of the draft gear when the horn touches the striking plate. Hence, when the coupler shank is 5 in. deep and the horn of the coupler is allowed to touch the striking plate before the draft gear is solid, the end force of 250,000 lb. is effective on a line located a distance  $Y$  above the center line of draft gear:

$$Y = 4.5 \left( 1 - \frac{R}{250,000} \right)$$

All cars are not of steel construction and perhaps the most troublesome problem is to decide what shall be done with

equipment having wooden center sills. Metal reinforcement between the end sill and bolster and for a limited distance behind the bolster has been very successful when applied as an intimate member with the sill and secured thereto in two directions, vertically and horizontally. The curve shown in Fig. 6 covers an analysis of center sill strains worked out for a 36-ft. wooden underframe box car (empty) having six sills of 5 in. by 9 in. section. The strains covered are: Dead weight, assumed to be 1,000 lb. per lineal foot of car; buffing shock, assumed to be 100,000 lb., applied 8 in. below the neutral axis of the sills.

The bending moment in an empty car, due to the dead load is downward between the bolsters, but the combined moment resulting from the dead load and buffing shocks is upward throughout the sills and the truss rods perform no

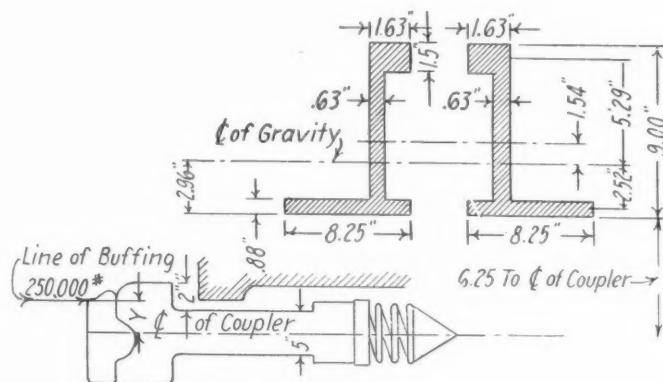


Fig. 7

work. The following is a typical example covering a draft arm problem:

Consider the section over center line of bolster. (See Fig. 7.)

Coupler = 5 in. by 7 in. shank.  
 Draft gear = 2 class G springs or 60,720 lb.  
 Buffing force = 250,000 lb.

Distance between line of buffing and center line of coupler =

$$Y = 2 \text{ in.} + \frac{1}{2} \text{ shank depth} \left( 1 - \frac{\text{Resistance of gear}}{250,000} \right)$$

$$Y = 2 \text{ in.} + \frac{1}{2} \left( 1 - \frac{60,720}{250,000} \right) = 3.41 \text{ in.}$$

	A	B	AB	D	AD <sup>2</sup>	i	I
Web plate—2 x .63 in. by 9.0 in. ....	11.34	4.5	51.03	1.54	26.88	78.55	103.43
Top chord—2 x 1.0 in. by 1.5 in. ....	3.0	8.25	24.75	5.29	83.94	.56	84.50
Bottom chord—2 by 7.62 in. by 0.88 in. ....	13.41	.44	5.9	2.52	85.15	.....	85.15
Total .....	27.75	.....	81.68	.....	.....	.....	273.08

A = Area.

B = Distance from base of section to center of gravity of each unit.

D = Distance between center of gravity of section and center of gravity of each unit.

i = Moment of inertia of each unit about its center of gravity.

I = Moment of inertia of each unit about the base of the section.

$$\text{Center of gravity of section above base} = \frac{AB}{A} = \frac{81.68}{27.75} = 2.96 \text{ in.}$$

The distance between line of buffing and center of gravity of the section, or the eccentricity, is equal to 6.25 in. — 3.41 in. + 2.96 in. = 5.8 in.

$$\text{Section modulus} = \frac{273.08}{5.29} = 51.62$$

(The section modulus is taken about the center of gravity of the upper flange.)

$$\text{M. C. B. ratio} = \frac{1}{A} + \frac{\text{eccentricity}}{\text{Section modulus}} = \frac{1}{27.75} + \frac{5.8}{51.62} = 0.149$$

The M. C. B. requirements for this ratio are .15 or less.

The average safe allowable bending moment for six 5-in. by 9-in. (45 x 6 = 270 sq. in.) yellow pine sills is 486,000 in. lb. The maximum bending moment over the bolster (being the combined moment of dead load and 100,000 lb. buffing shock) is 981,500 in. lb., or about double the safe load. By examining Fig. 6 it will be noted that the sill support will have to extend somewhat beyond 3 ft. inside of the bolster as the strain curve crosses the 486,000-in.-lb. limit at a distance of 3 ft. 11 in. Another point to be accounted for is

the fact that in practically all cases sills break over the bolster, the point of maximum intensity, and if the draft sills are extended behind the bolster it is possible to form a substantial connection with bolts and tie plates.

Where wooden and steel sills are to operate in unison, and this should be considered for buffing shocks, it is necessary to provide a cross sectional area of steel equal to one-fourth of that in the wood. For instance, with the center and intermediate sills located very closely together an area of 4 x 5 in. x 9 in. = 180 sq. in. is obtained and  $180 \div 4 = 45$  sq. in. of steel will be required. A continuous draft sill of these proportions would weigh more than 150 lb. per lineal foot or add considerable more than 5,000 lb. to the original weight of the car, it would not be self supporting and the bending moment due to the dead load of the empty car would be increased. A built-up type of crosstie would have to be designed in order to allow the draft sills to be continuous and the bolsters would have to be re-designed if the buffing shock was to be applied normal to the neutral axis of the draft sills.

The reasoning is a little crude in form, but it explains in a large measure, the very satisfactory performance of such application of reinforcement, as compared with a continuous metal member from end to end of the car.

## HOT BOXES REDUCED BY FOLLOWING INSTRUCTIONS\*

BY J. C. MENDLER

Foreman, Avis Yard, New York Central, Jersey Shore, Pa.

Hot boxes may be eliminated to a great extent if oilers are thoroughly familiar with and follow instructions as to the care and lubrication of journal boxes.

Mechanical defects may be responsible to a certain extent for hot boxes; these defects, however, are not the result of faulty design, but are due to careless preparation prior to application of wheels and bearings, and can readily be eliminated by the exercise of a little care.

The principal cause of hot-boxes is improper placing and care of packing. In all cases a roll or twist of waste which has been dipped in oil and thoroughly drained should be placed in the rear of the box. The balance of the packing should be fed under the bottom of the journal and forced into place so that it rises along the sides to the center line of the journal. In placing packing, all pressure should be exerted under the journal, as this insures a firm medium of lubrication at the bottom and will force the sides into proper position. The packing along the sides of the journal should extend forward to the inside of the collar of the journal. A loose piece of waste having no connection with the remainder of the packing should be placed in front of the box, rising not more than  $\frac{1}{2}$ -inch on the collar and slightly tapering toward the front of the box to assist in holding the packing on the sides in place. Care must be taken that the packing is firmly placed; if loosely placed it will settle away from the journal and lubrication will cease when the car is in service.

The packing in each box should be inspected at the terminal yards to determine if it is properly placed. The natural tendency of packing is to move toward the front of the box, hence the oiler should insert the packing iron along the sides of the box to determine if the packing has worked away from the rear. If the rear of the box is not properly protected by packing, the oil when brought to a running heat will be lost. The oiler can remedy this defect by placing the packing iron under the journal and forcing the packing back into place.

Packing which has been in use for some time and which may have been subjected to heat has a tendency to become dry and glazed where it has been in contact with the journal.

\*Entered in the Hot Box Competition which closed October 1, 1916.

When this condition is found the packing should be removed and fresh packing substituted.

Another cause of journals heating is the presence of strands of waste which work under the bearing and become firmly lodged, wiping the journal dry and preventing lubrication. This can be prevented by removing the surplus packing which rises above the center line of the journal. Some roads are apparently packing boxes with the idea that the maximum amount of packing means the maximum amount of lubrication. This is a fallacy and a bad practice, as the packing which rises above the center line of the journal is a source of danger; when the bearing rises slightly under running and switching shocks these high strands have an opportunity of getting under the bearings.

Another cause of hot-boxes is the false idea of economy so generally prevalent relative to the number of men necessary to handle oiling properly. As an example, a recent article in the *Railway Mechanical Engineer* suggests a force of ten car inspectors and four oilers in a yard where from 1,200 to 1,500 cars are handled in 24 hours. A reversal of these figures would undoubtedly give better results in reducing the number of hot boxes.

Last, but not least, a considerable number of hot boxes are due to improper attention on the part of the supervision. Too often, the man in charge is prone to entertain the idea that car oiling is not sufficiently important to occupy much of his time and attention and can be slighted in favor of more pressing duties. Instructions, charts, etc., are furnished the car oiler, but these things are often confusing to the man with the packing iron. A practical demonstration as to the proper method of packing a box, and how and where to look for defects in the packing, and how to remedy these defects when found, given by the man in charge to the man who performs the work, should and will work wonders in the elimination of hot boxes.

## CARELESSNESS AND IGNORANCE RESPONSIBLE FOR HOT BOXES\*

BY W. H. HICKOK

Traveling Car Inspector, Delaware & Hudson, Watervliet, N. Y.

One of the greatest problems that the railroads have to solve today is that of hot boxes, especially in freight service. To overcome and reduce hot boxes on freight cars to a minimum, we must first have competent instructors as well as competent oilers and box packers—men who will follow instructions and not slight their work.

At the interchange yard every box cover should be raised, and condition of packing carefully examined. This can be done by the inspector stirring up the packing with his packing iron. He should next examine the condition of the brass for end wear, and see if the babbitt has moved or is hanging on the side of the brass, preventing the oil from getting under the bearing; also for any other defect which can be seen by looking into the front end of the box. By doing this, broken brass and wedge, brass having too much end wear, or wedge out of place can be corrected, and in the majority of cases will prevent a hot box. If the car oiler finds the brass and wedge in good condition, packing clean and not cut up, he should work up the packing with his iron, taking care that the packing does not come above the center line of the journals, running all the way back. If packing is found dry, apply a little free oil on the rising side of the journal. When the oiler has finished, box covers should be closed and only those left open that require the boxes to be pulled and repacked by the box men.

Foremen in charge should see that the proper box covers are applied by the light repairmen when missing. There is not enough attention given to missing covers. When left off

\*Entered in the Hot Box Competition which closed October 1, 1916.

the packing becomes gritty very quickly, hinders the flow of oil and often works up under the bearing, causing friction. The inspector must see that the lading on open cars is properly distributed, not too much on one bearing. If journals are running extra warm on a loaded car the inspector should ascertain the amount of lading the car is carrying. Station agents can also help by preventing shippers from overloading cars.

A great deal of trouble can be overcome at the repair track by having all boxes carefully inspected for broken brasses and wedges, and all boxes pulled, unless they have been packed recently. Boxes should be cleaned of all grit and the cut up and dirty packing shaken out, re-applying that which is in good condition. Boxes should be packed as follows: A handful of packing, rolled and twisted into the form of a rope should be inserted in the back of the box to act as a dustguard. The box should then be filled by working the packing up to the center line of the journal, the centering hole in the end of the axle serving as a guide for height. Care should be taken to keep the packing inside the journal collar, and not pack the box too tightly. A handful of packing should then be placed in front of the journal as a wedge to keep the packing on the sides in place. This has no connection with the packing on the sides or beneath the journal. No loose ends of packing should be left hanging out of the box to act as syphons in drawing the oil out of the box. The box must not be filled above the center line of the journal, as packing above that point is liable to be caught and drawn in between the journal and the bearing, producing friction. Packing at this point keeps the oil from feeding under the bearing.

It is important when applying wheels to see that the journals are thoroughly cleaned before applying the bearing, and a little oil rubbed over the surface of the babbit. Special attention should be given to the fitting of the bearing on the journal, for an uneven bearing soon causes friction.

The maintenance of dustguards is also of great importance. When properly fitted, they prevent a great deal of dust and grit from getting into the rear end of the box. It is equally important to keep the trucks square. This prevents the bearing from binding on the journal, resulting in a hot box.

It often happens that hot boxes are caused not from the lack of knowledge of these facts, but from mere carelessness on the part of the men doing the work. If more care were taken and these suggestions followed out, the problem of hot boxes would soon be overcome, or at least reduced to a minimum.

## WHY NOT HAVE CAR DEPARTMENT APPRENTICES?\*

BY GEORGE A. MARLOW  
Foreman, Pennsylvania Railroad, Kane, Pa.

"Who ever heard of serving an apprenticeship in the car department?" was a question asked of me not long since by an engine house foreman. Having been a car department employee during my entire railroad career it naturally set me thinking.

Young men are being trained in locomotive work, machine shop practice, electric lighting, railway signaling and what not. But the car work has been lost sight of, except on occasions when a car man uses "bad judgment" or makes a mistake in the application of that set of complications called the M. C. B. rules. Then the car man comes to the front, is disciplined with a reprimand, suspension or possibly dismissal, for an offense of which he is entirely ignorant. What is done to prevent a recurrence of "bad judgment," or mistakes? Well, we all do about the same thing—give the car man a lecture on what he ought to know, and what he ought

to do, and try to inject a little "pep" into the department in general, after which matters appear to run more smoothly for a time. However, the old roadbed is easier to run on than the new and before long the men are back again to their easy going methods. And why? The answer is: "Who ever heard of serving an apprenticeship in the car department?" If all railroads would begin today to use as much care in employing and educating young men for the car department as they do for their other departments, they would not be bothered with the car man "who didn't know."

There are various opinions as to the exact place where a car apprentice should begin, and through what channels the line of advancement should be. May I suggest the following schedule:

### FIRST YEAR (Entirely in Yard)

Three months as a car ciler.  
Three months as a car repairman on running repairs.  
Three months as a car repairman on yard repair track.  
Three months as an air brake repairman.

Immediately upon being employed the man should be enrolled as a pupil of the educational department; the courses for the first year to be as follows: Arithmetic, simple lessons in car construction, geometrical drawing, first year air brake instructions and United States Safety Appliance standards. Examinations should be prepared once each week under the supervision of the foreman of the car department. The apprentice should also be furnished with the M. C. B. Rules of Interchange, M. C. B. Rules for Loading Materials and the Instructions for Loading Explosives and Inflammable Articles.

Following is the proposed schedule for the second year:

### SECOND YEAR

Three months as a car inspector in the yards (interchange yards if possible).  
One month as a passenger car cleaner.  
Two months as a passenger car repairman (running repairs).  
Three months as a passenger car light repairman.  
Three months as a planing mill hand.

The educational department during this year should furnish courses in: Mechanical drawing, mathematics, electric car lighting, air brake instructions, interpretations of the M. C. B. Code of Rules and further instructions in United States Safety Appliance standards. Examinations should be conducted as in the first year.

The third year should include the following:

### THIRD YEAR

Four months as a car repairman on wooden cars.  
Three months as a car repairman on steel cars.  
One month as an air brake repairman.  
One month as a car painter and stenciler.  
One month as a piece work inspector (after completion).  
Two months as an M. C. B. billing clerk.

The instruction to be furnished by the educational department during this year should include mechanical drawing (including all classes of car construction), air brake instructions, mathematics and general instructions in the various books of rules.

That would possibly enable us to handle the new men. but what are we going to do with the old men? I feel that the old axiom "A man is never too old to learn" is quite fitting in this case. The old men can be educated along simple lines, making them more efficient than at present and enabling them to fulfill their various duties until such time as the railroad might give them an easier berth in which to finish their railroad careers.

**STEEL CARS.**—In its ability to produce war orders completely within its own plant, the Nova Scotia Steel & Coal Company occupies a unique position. Out of the many thousands of cars built in America, in the past year for the Russian Government, that company, with its order for 2,000 cars, is probably the only builder which mined the ore, fabricated the material and delivered the cars in Asiatic Russia without calling in the aid of any other concern, either for raw material, the manufacturing or the transportation.—*Compressed Air Magazine.*

\* Entered in the Apprentice Competition of the Chief Interchange Car Inspectors' and Car Foremen's Association and presented at the annual convention, Indianapolis, Ind., October 3, 4 and 5, 1916.

# PASSENGER CAR FOUNDATION BRAKE RIGGING\*

A Discussion of the Defects Found in the Gear for the Single Shoe Brakes When Applied to Heavy Equipment

BY WALTER V. TURNER  
Assistant Manager, Westinghouse Air Brake Company

THE foundation brake rigging has an important bearing on the matter of train control. The advantages of improved types of air-controlling devices can be realized only in minor degree unless improvements be made in the foundation brake gear, which today is the weakest link in efficiency in the whole air brake system. The first and essential requisite of foundation brake rigging is that it be designed with due regard to the strength, rigidity, and arrangement which will always maintain the proper volume proportions between the brake cylinder and auxiliary reservoir; that is to say, it must provide a piston travel constant as nearly as possible under all variations in cylinder pressure. Also, it should not apply to the wheels unbalanced lateral pressures so great as to force the journal out from under its bearing, causing journal troubles, and to cause excessive binding between journal boxes and pedestal jaws, thereby permitting a shifting of weight from one pair of wheels to another, due to irregularities in the track surface, and causing wheel sliding. Suitable truck design cannot be dissociated from these requirements for adequate brake rigging.

The single-shoe-per-wheel type of foundation rigging in such prevalent use meets none of these requirements. The lack of

mitted by the just-mentioned spring suspension, pulls the shoe down into the dotted position, and this cumulative effect on each wheel results in the false piston travel  $RS$ . The operation of the automatic slack adjuster returns point  $S$  and, of course, point  $R$  towards point  $T$  until distance  $TS$  equals the setting of the slack adjuster. This reduces distance  $RT$  and, therefore, the brake shoe clearance for release position until in many cases  $RT$  actually becomes zero. Point  $T$  represents the release position of the piston and point  $R$  that piston position where the shoes first come against the wheels. That is, there is very much reduced shoe clearance, or none whatever, with the single-shoe type of brake rigging. And dragging shoes mean highly increased train resistances, with the corresponding reduction in motive power capacity, increase in fuel and water (or electric power) consumption, and shocks due to the necessity for "taking the slack" in order to get a train under way.

The point very difficult for many to grasp, when this action of the automatic slack adjuster is explained (and they immediately suggest dispensing with the adjuster altogether) is that without the adjuster point  $S$  might go out so far that the brake piston would strike the non-pressure cylinder head.

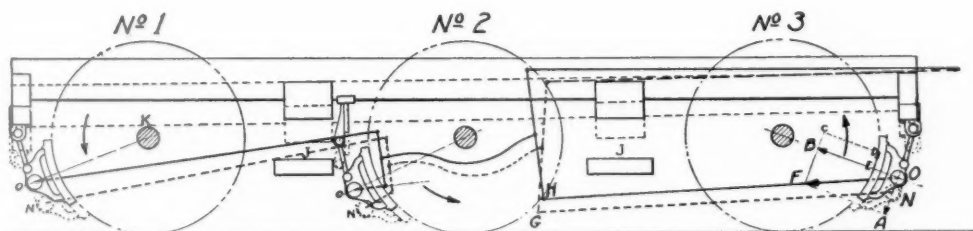


Fig. 1—Relative Positions of Brake Rigging with Light and with Full Service Applications

proper brake cylinder volume proportion maintained by this single-shoe type of rigging is illustrated in Figs. 1 and 2. In Fig. 1 the position of rods, levers, truck frame, and shoes, shown in full lines, are those for the cylinder pressure (about 5 lb.) necessary to just bring the brake shoes against the wheels. The dotted lines show corresponding positions when the cylinder pressure has been built up to some value appreciably higher, such as that for a full service application. The difference in piston travel which this variation in cylinder pressure makes is represented by the distance  $RS$  on the center line of the cylinder. This is false piston travel. The pulling down of the truck frame and other parts from the full line to the dotted line positions is caused by the brake shoes being hung at a point on the wheel considerably below the horizontal center line and being hung from the truck frame, which is separated from the journal boxes and the wheels by the usual truck springs. The braking force being applied along the pull rod  $OH$  (note the No. 3 pair of wheels for lettering) gives a tangential component  $OA$  at the brake shoe, which, per-

And this it would do unless careful and repeated manual adjustments were made—adjustments almost impossible to accomplish in the comparatively minor degree required under present conditions. Moreover, such adjustments would merely duplicate in a laborious way the work of the present slack adjuster, and this remedy would provide no betterment whatever. The only "fault" the automatic slack adjuster has is that of revealing the evil of false piston travel and the necessity for striking at the fundamental cause in order to effect a cure. Also, in this same connection, it is well to mention that the slack adjuster should take up about one thirty-second of an inch only for each operation instead of the full distance the piston travels beyond the adjuster setting. Otherwise, where the full overtravel is taken up with one adjuster operation, an unusually high cylinder pressure, such as obtained in emergency, would cause the shoes to grip the wheels, with the air exhausted from the cylinder, to such an extent that the car could not be moved at all.

The distance  $RT$  represents the piston travel for light brake pipe reductions, and, as before pointed out, short piston travel means correspondingly high cylinder pressures and, therefore, severe shocks in long trains, due to serial brake

\* Taken from a paper on Vital Relation of Train Control to the Value of Steam and Electric Railway Properties, presented before The Franklin Institute.

action. What this false piston travel means in the way of giving high cylinder pressures for a light brake pipe reduction at just the time when they are not wanted is shown in Fig. 2. When high pressures are desired heavier brake pipe reductions can readily be made, but if flexibility is to be had it is indispensable that the brake installation permit obtaining light cylinder pressures as well as heavy ones.

Piston travel, where the type of rigging permits it to vary, is a function of the time or duration of brake application, as well as of the cylinder pressure. For a condition of 4 in. false piston travel, as shown in Fig. 2, dotted curve A, in the upper figure, represents more nearly what the variation in travel with cylinder pressure would be for an actual brake application, for the piston travel will not lengthen out immediately. It takes a certain period of time for the jolting of the cars and trucks to assist the brake shoes to pull down on the wheel treads, as illustrated in Fig. 1 and thereby lengthen the piston travel. This is significant, because the shocks occur in the early stages of a brake application. Curve B in the lower figure shows what the condition portrayed by curve A means in the way of high cylinder pressures for light brake pipe reductions. At the point (6 lb. brake pipe reduction) where the brake with the ideal condition of no false piston travel whatever is just starting to become effective, the single-shoe brake rigging with 4 in. false piston

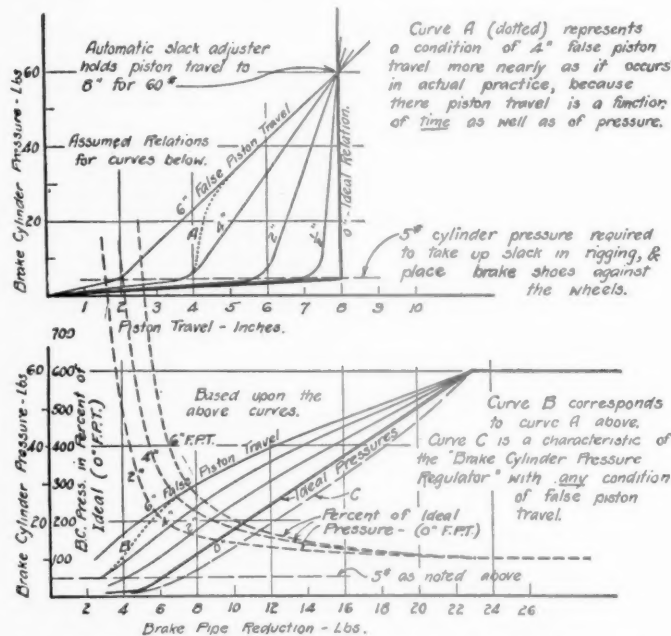


Fig. 2—Effect of False Piston Travel on Cylinder Pressure

travel has about 21 lb. cylinder pressure, as shown by curve B. Is there any wonder that shocks occur in the long passenger trains of to-day? It is necessary to make at least a 6 or 7 lb. brake pipe reduction in order to insure that all triple valves apply and that sufficient differential may be set up to release them when desired. In the attempt to put the brakes on lightly and avoid shocks, insufficient reductions are made, with the inevitable result of stuck brakes.

All these things may be summed up in the following:

In modern heavy passenger train service, the single-shoe type of foundation brake gear with inherent false piston travel is responsible for:

1. Rough handling of trains in:
  - (a) Starting—violent "taking of slack" necessary to get train under way.
  - (b) Slowing down.
  - (c) Stopping.
2. Inability to "make the time" because of:
  - (a) Hard pulling train—due to dragging brake shoes and stuck brakes.
  - (b) Long-drawn-out stops—"dribbling on" brakes in attempt to avoid shocks.

3. Unwarranted expense in:
  - (a) Excessive fuel and water consumption.
  - (b) Reduced capacity of locomotive.
  - (c) Slid flat wheels due to shocks, stuck brakes, and shifting of weight from one pair of wheels to another.
  - (d) Damage arising from shocks, even causing break-in-tuos.
  - (e) Hot journals.
  - (f) Burned brake shoes and brake heads.

Obviously, the way to cure these troubles is not to dally with the effects, but to strike back to the underlying causes

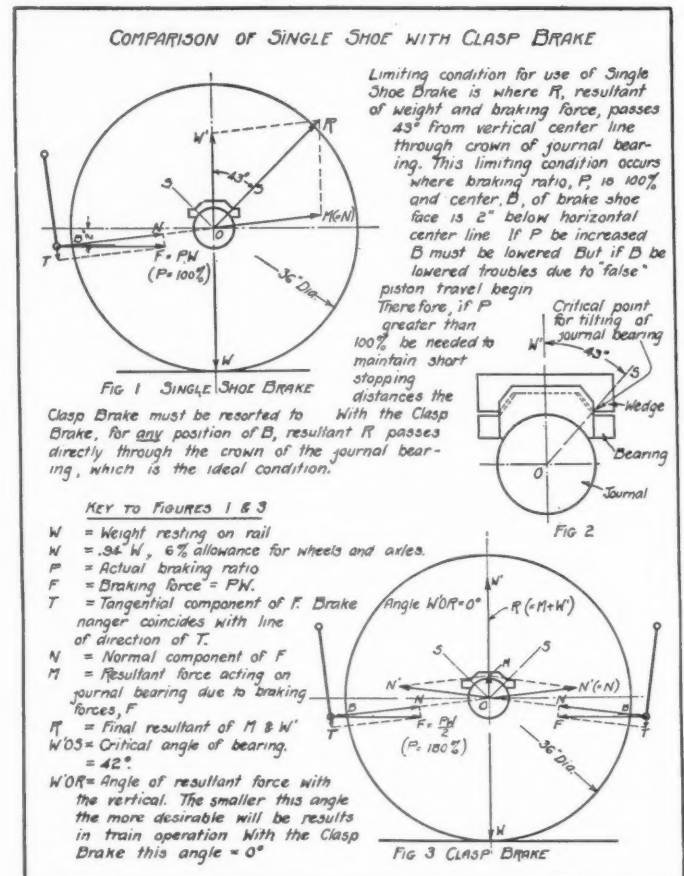


Fig. 3.—Resultant Forces on Wheel with Single Shoe and Clasp Brakes

by applying a suitably designed foundation brake gear of the two-shoe-per-wheel or "clasp" type. The part the single-shoe brake plays in giving journal trouble, and the remedy the clasp brake affords is illustrated by Fig. 3. It proves that the clasp brake should be employed whenever it is necessary to exceed a braking ratio of 100 per cent for either emergency or service applications. And if the point is taken as here established for the failure of the single-shoe brake to be "equal to the job," the need for the clasp brake on account of the overloaded brake shoe will have been cared for long before it arises.

In summing up, it may be said that a well-designed clasp-brake rigging eliminates the single-shoe brake evils above scheduled as no other device can possibly do. A more direct comparison may be drawn up between the single shoe and clasp types of brake gear by saying that with the clasp brake it is possible to have:

1. Shorter stops in emergency, due to reduced brake shoe duty.
2. Reduced brake shoe wear.
3. Reduced brake shoe maintenance.
4. No brake shoe dragging—reduced train resistances.
5. Longer trains handled with less loss of time, using same motive power equipment.
6. Fewer delays.
7. Smoother stops.
8. More accurate stops.
9. Fewer slid flat wheels.
10. Fewer stuck brakes.
11. Fewer hot journal bearings.



# Shop Practice



## MASTER PAINTERS TELL OF BENEFITS FROM CONVENTION ATTENDANCE

Three members of the Master Car and Locomotive Painters' Association entered letters in the competition for the best expression as to the benefits derived from convention attendance. They are as follows:

BY C. E. COPP\*

Foreman Painter, Billerica Shops, Boston & Maine, North Billerica, Mass.

The Master Car and Locomotive Painters' Association is a mechanical department organization junior only to the Master Car Builders' Association. If experience is anything to qualify a man to speak on the benefits derived from membership in it it seems as if I might be qualified, for the convention at Atlantic City last September was my twenty-fourth without a break. This is enough to get the run of things and average up a fellow as a fair sample, for I have been a constant attendant upon the sessions and president of four conventions.

Specific instances of improvement, however, are wanted. It is difficult to particularize in this matter. I can say that I am an entirely different man from what I was before I began to meet with my fellow workers in annual convention. Then I thought I knew all that was worth knowing, and it was hard to teach me anything more or better than I knew. Now I fully realize that there are scores in this broad land among the various railroads who have been up against just as hard problems as I have, if not harder, and are qualified to teach me many things in my line. Conventions, at least put a man of sense in a receptive mood. If they do not do this he is a hard-shelled egotist and a hopeless case, and had better stay at home, or take a vacation where he can catch fish, for no man can catch ideas at a convention in that frame of mind.

Associations are for the mutual improvement of their members; and the conventions are where they meet for the interchange of ideas. There should be nothing selfish about this. The man who is teachable is apt to teach others. If he meets with his fellows for what he can absorb without imparting anything, he is indeed selfish. On the contrary, if he goes to the meeting bent on hammering his ideas into others and not manifesting a desire to receive and put into practice some of the things he hears, he is an egotist of the first magnitude, to be shunned as such by all who know him.

One who is new at attending conventions might put his finger on the very thing that helped him, but another who has been in the school for many years and has heard all subjects threshed out, not only once but many times, finds it hard to jump up and shout the commendations of any one or two things that benefited him most. A new scholar readily finds a new-found joy, but one old enough to graduate can speak only of the general good the school has imparted to him. It is much the same with association membership and conventions, I fancy. The benefits come surely enough, and are imparted to the company employing him, if it cannot be specified and figured up in dollars and cents. He is broader, more energetic, more efficient, for he feels no longer like one

of "the dumb driven cattle, but a hero in the strife." He gets out of ruts and gets into new ways of seeing and doing things.

I remember years ago galvanized iron entered largely into deck construction of passenger equipment, and I supposed there could be no better coating for this troublesome material than white lead and oil paint, but it got brittle and scaled so quickly that it puzzled me and it remained for John A. Putz of the Wisconsin Central, long since passed away, to straighten me out in this matter at one of our conventions, by saying that there was no better primer for galvanized iron than a good outside car finishing varnish. I tried it and became convinced.

Many other things I could relate if I could recall them. I once got the notion firmly embedded in my head, and wrote a convention paper upon it, that the exteriors of passenger equipment could be finished in enamel exclusively, but it took "Jim" Gohen, formerly of the Big Four, to give me a rude shock and right me up by an address in which he concluded by saying, in substance, "Boys, there's nothing like varnish for finishing passenger equipment exteriors, though you may well treat decks, trucks and steps with enamel." And I was not long in seeing the wisdom of this statement, though reluctant to be convinced at the time. This is important at the present time because a method of finishing cars to the exclusion of clear varnish is being widely championed and advertised.

BY J. W. GIBBONS

General Foreman, Locomotive Painters, Atchison, Topeka & Santa Fe, Topeka, Kan.

Prior to joining the Master Painters' Association my spare time was devoted to a study of the political affairs of our country, or given to the promotion of the fraternal societies of which I was a member, and my vacations were spent in attending the conventions of these societies. I have no desire to detract from the good that these organizations are doing, and, in fact, they should be credited with giving me an experience in dealing with men and in the handling of business in legislative bodies, that has been of great material benefit to me, but the study of the problems which were involved in these conventions diverted my mind away from, or at least took the time from the technical study of, materials and methods used in my own business.

In the Master Painters' Association I met men of wide experience, who not only had the practical but also the technical knowledge of materials which go to make good paint or varnish. The opportunity of meeting and interchanging ideas with these men as to working conditions and materials was, in itself, a great advantage, but affiliation with this association also concentrated my thoughts on the study of the business in which I was engaged.

I was only a member a short time when a subject was assigned to me on which to prepare a paper for presentation at the Ottawa convention. Being a believer of the old saying that anything worth doing is worth doing well, I studied the subject assigned to me from all angles; the result must have been satisfactory for my next assignment was to the chairmanship of the Test Committee. It was with a great deal of hesitancy that I accepted this position, but I set to work and

\*Mr. Copp was awarded third prize.

studied paint materials, not only from a practical standpoint, but also from the chemical point of view. (Let me state right here that no matter how much experience from a practical standpoint a man may have, a knowledge of the rudiments of the chemistry of paints will be of great benefit to him and the company he serves). This led me to the reading of papers and magazines devoted to the discussion of paint from the technical as well as the practical standpoint. Thus equipped the result of my work as chairman of the Test Committee of the Master Car and Locomotive Painters' Association for the past three years speaks for itself.

As to the benefits to a member in an association of this kind, I would say that it lies within himself to derive much or little. If he attends the meetings and listens to the discussions only, he will secure information that will be of assistance; if he attends the sessions regularly and participates in the debates he not only secures information but acquires practice that gives him confidence in himself and his ideas. I want to emphasize this statement as many men in railroad work have splendid ideas but lack the confidence in themselves to express them.

Last, but not least, are the friendships I have formed which have not only given me great pleasure but have broadened my view of life itself.

The benefit to my employer lies in the fact that the company now has an employee whose mind and reading has been concentrated upon his work and the increased efficiency acquired by these studies and interchange of ideas with men who are in the same line of work. The company also receives the benefit of the increased protection to its property through the knowledge acquired by the tests which are made under the auspices of this association.

BY N. J. WATTS

Foreman Engine Painting Department, Nashville, Chattanooga & St. Louis,  
Nashville, Tenn.

Having had the pleasure of attending the Master Car and Locomotive Painters' Convention for a number of years I am able to state from experience that it is to the benefit of the railroad to send the foreman painters to the meetings.

As a rule too little consideration is given to the painting department (and especially the engine painting) by the management.

By attending the Master Painters' Convention and discussing the problems and hearing them discussed by men who have kept abreast of the times I have been greatly benefited and have been able in many ways to use the ideas for the benefit of my employer. I remember at the first of the conventions I attended (Niagara Falls, 1909) I talked with a number of engine painters in regard to the methods and the material they used and found that my company was using more expensive material and getting no better results than was being obtained by others with a much cheaper material. I suggested to my company that we try it; the result was satisfactory and we have used it for several years, thereby saving a considerable amount of money. This is only one of many ways in which the association meetings have been a help and benefit to me, and through me to the railroad. I believe if the railroad officers would take a personal interest in these meetings it would be of incalculable benefit. I remember that at our meeting in Denver, Col., the superintendent of the Denver & Rio Grande met with us and addressed the meeting and how much it was appreciated. (Kind of a "reciprocity feeling," don't you know.)

Then, too, if the officials would make use of the different committees of the association it would be another source of help to both. For instance, the Committee on Information could be of great benefit to superintendents in solving doubtful points. The Test Committee is also of great importance. All who attend the convention are enabled through this committee to see different materials demonstrated, good and bad.

This means the foreman painter can see what is best on the market, learn prices, etc., and by advising with his superintendent or purchasing agent save the company much time, money and trouble.

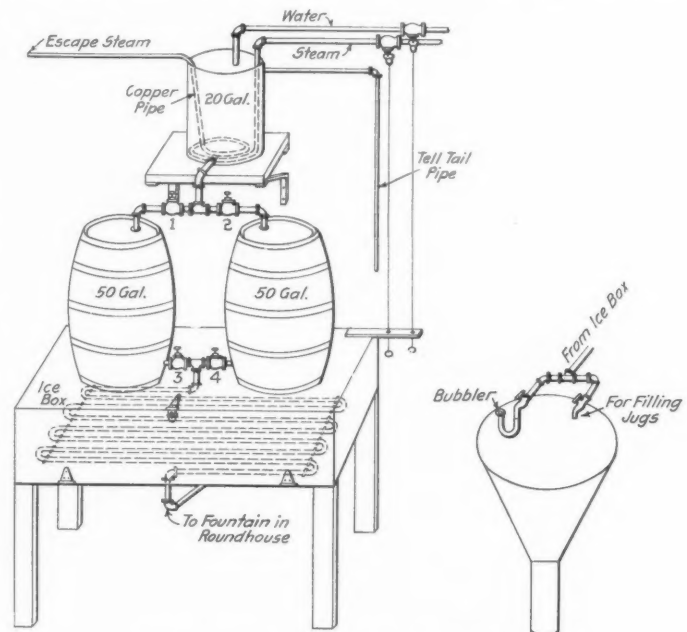
And last, but by no means least, not only has the foreman and the company he represents been benefited by the knowledge he has gained, but he has had a pleasant outing that has enthused into him new life and new ambition.

## PURIFYING SHOP DRINKING WATER

BY W. S. WHITFORD

General Foreman, Chicago & North Western, Milwaukee, Wis.

At the shops of the Chicago & North Western in Milwaukee, Wis., lake water is used for drinking purposes. There are times when this water is not suitable for drinking without purification and the health officers have ordered that it be boiled. The arrangement shown in the illustration was devised to do this and it has been giving entire satisfaction. It consists of a 20-gallon tank set above two 50-gallon barrels, which rest on an ice box. The lake water is fed into the 20-gallon tank and it is boiled by passing steam through a coil located in the tank, as shown. The process of filling the tank is as follows: The 20-gallon tank is first filled with water and the steam turned on to boil it, valves 1 and 2 being closed. The water will be boiled enough in three minutes time to kill all the germs. The 20-gallon tank is then emptied into either of the 50-gallon barrels and the process continued until the barrels are full. When one has been



Arrangement for Purifying Drinking Water

emptied—the left one, for instance—the water is boiled with valves 1 and 2 closed. Valve 3 is also closed and the system is fed through valve 4 from the right hand barrel. The left hand barrel is then filled with boiled water through valve 1. The apparatus is set just outside of the roundhouse, completely enclosed and it takes 30 minutes every morning and evening to give the necessary supply of water. Everything is covered so nothing can get into the water and it is always ice cold after it has traveled through the coils of the pipe in the icebox. At the right of the illustration is shown the bubbler drinking fountain and a tap for drawing off the sterilized water for the enginemen's jugs.

**ANTHRACITE COAL.**—The reports for the year 1915 show that 88,995,061 short tons of Pennsylvania anthracite were mined.

# ELECTRICAL EQUIPMENT REPAIR SHOPS

## Description of the Facilities for the New Haven at Van Nest, N. Y., for Handling Electrical Rolling Stock

THE New York, New Haven & Hartford now operates over 100 electric locomotives, 27 motor cars and 76 trailers and the repairs to this equipment are made at the Van Nest shops, located on the outskirts of New York City. These are the largest and best equipped plants ever built for the maintenance of heavy traction electrical equipment. In addition to doing general repair work, motors and wheels on freight and switching locomotives are changed, and heavy repairs are made in case of damage due to accidents. Passenger locomotive motors and wheels, however, are usually changed at Stamford, Conn., when such work is necessary between overhaul periods. Both Stamford and Oak Point, New York City, have facilities for inspection and light repairs to electrical equipment, and none of this work is done at Van Nest.

The machine shop facilities at Van Nest are taken advantage of in the manufacture of various small parts used

The armature winding department is located at the east end of the heavy machine tool bay, where it is conveniently reached by the overhead crane and is adjacent to the oven used for baking coils.

The manufacturing balcony extends the entire length of the south side of the shop above the small machine tool bay. Miscellaneous parts required for maintenance are made here, including switch group contactors, blow-out coils, pantographs, third rail shoe mechanisms, brush-holders, etc. Bearings are re-babbitted; and relays, switch groups and other apparatus are also assembled here. Besides the machine shop, this department has a carpenter shop and a small brass foundry. The parts manufactured here are sent to the store-room and charged to the stores department.

### HEAT, LIGHT AND POWER

An outstanding feature of these shops is the excellent natural lighting, obtained by skylights throughout the length of the main building and by a row of large windows above and below the crane track, occupying practically all available wall space. The photograph of the erecting shop (Fig. 2) is a good illustration of the results obtained.

Artificial lighting for general illumination is provided by large unit incandescent lamps and reflectors suspended near the ceiling. Extension line receptacles are liberally provided. On the larger machine tools, the wiring for adjustable lamps is placed in flexible metal conduit coming up through the floor, which overcomes the objections to drop lights and extension cords. A forced air heating system maintains a comfortable temperature in the shops during the coldest weather and provides effective ventilation.

All electrical power used in the shops is three-phase, 25-cycle, distributed at 550 volts. The power comes from the three-phase bus at Cos Cob, Conn., about 20 miles from the shops, from which single-phase power is taken for propulsion, and although it is slightly unbalanced, the effect is not noticeable on the motors. All machine tools are direct driven by individual three-phase induction motors and no line shafts or belts are used. This type of installation contributes to the effectiveness of the shop lighting by the absence of belts and line shafts. The equipment is moved into and out of the building by a small steam switching locomotive.

### SYSTEM OF OVERHAULING EQUIPMENT

When a locomotive comes in for general overhauling it is at once placed in the erecting shop and taken apart completely. As all parts are interchangeable between locomotives of the same type, it is re-assembled with such parts as are available, and not necessarily with the equipment it contained originally.

Axles and motors are dropped out, the cab lifted from the trucks, and the transformer, switch groups, air compressors, etc., are removed for repair or renewals. The traction motors are dismantled and the fields and armatures are dipped in varnish at 190 deg. F.; then baked for 72 to 100 hours. The practice of dipping the windings at each overhaul period has been found effective in reducing insulation failures. The commutators are also turned and undercut at this time.

A great many effective machines and methods have been developed at Van Nest to meet the unusual problems encountered in handling electric rolling stock. A cab or a motor-car body is handled with two pairs of hooks and two overhead cranes (Fig. 3). Adapters are used on the hooks to fit the various shapes of underframes. A 300-ton vertical

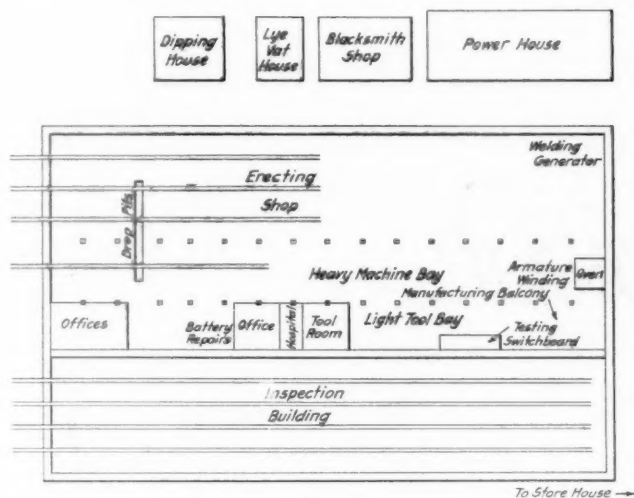


Fig. 1—Arrangement of the Van Nest Shops of the New Haven

in the ordinary maintenance and repair work on electrical equipment.

### ARRANGEMENT OF BUILDINGS

As shown in the diagram (Fig. 1) there are two principal buildings, forming together one structure. The inspection building contains four pit tracks; it is used for such work as can be done from the pits, and serves also for storage room. A useful feature of the pits is a shelf walk on each side, on which a man stands when working, while others can pass beneath him along the bottom of the pit without interference; they also make it easy to get into or out of the pit at any point. An overhead platform between the tracks facilitates work on pantographs, enabling a man to cross from one locomotive or car roof to another.

The erecting shop and the adjacent heavy machine bay are each provided with overhead cranes running the full length of the main shop building. These sections are exceptionally well lighted by skylights and large side windows both below and above the crane tracks. The light tool bay occupies the southeast corner of the ground floor, under the balcony, and is lighted by side windows. A space is provided to the left of the office where work is done on the storage batteries used for control and lighting on locomotives, motor cars and trailers. A small motor-generator supplies direct current for charging the batteries.

hydraulic press is used for pushing out armature shafts, quills, commutators, compressing laminations, etc.

#### TESTING EQUIPMENT

The apparatus for testing air brake equipment, located on the manufacturing balcony, is one of the features of the Van Nest shop equipment. There are three separate outfits, two of which are shown in Fig. 4. The large rack shown in Fig. 4, contains train line pipes, hose couplings and equipment equal to that of a six-car train. This may be divided into three separate parts, each part with its engineer's valve as used on a motor car, freight locomotive or passenger locomotive, connected to distributing valves from the same equipment. A standard yard testing outfit is connected to the rack to represent the train line conditions for a 100-car train. This rack is used for special tests, and with it any conditions of air brake operation encountered on the road may be duplicated in making a test. There is also a standard

A transformer, motor generator and switchboard, on the ground floor, are provided to obtain any voltage, a.c. or d.c., required for testing the control equipment, air compressors and other apparatus.

#### SHOP EQUIPMENT

Two 60-ton Niles cranes serve the erecting bay and there is one 30-ton crane in the heavy machine aisle. These cranes are all equipped with both main and auxiliary hoists. There are three drop pit tracks in the erecting shop, served by a transfer pit with a narrow gage track and suitable trucks. A hydraulic plunger is located under each track, and equipment is provided so that work may be done in all three pits at the same time. Dropping out axles is accomplished as in steam railroad shops, but special equipment is required to handle the geared motors, which are removed from below after the drivers are dropped out. With this equipment, a passenger locomotive motor and driving axle can be changed

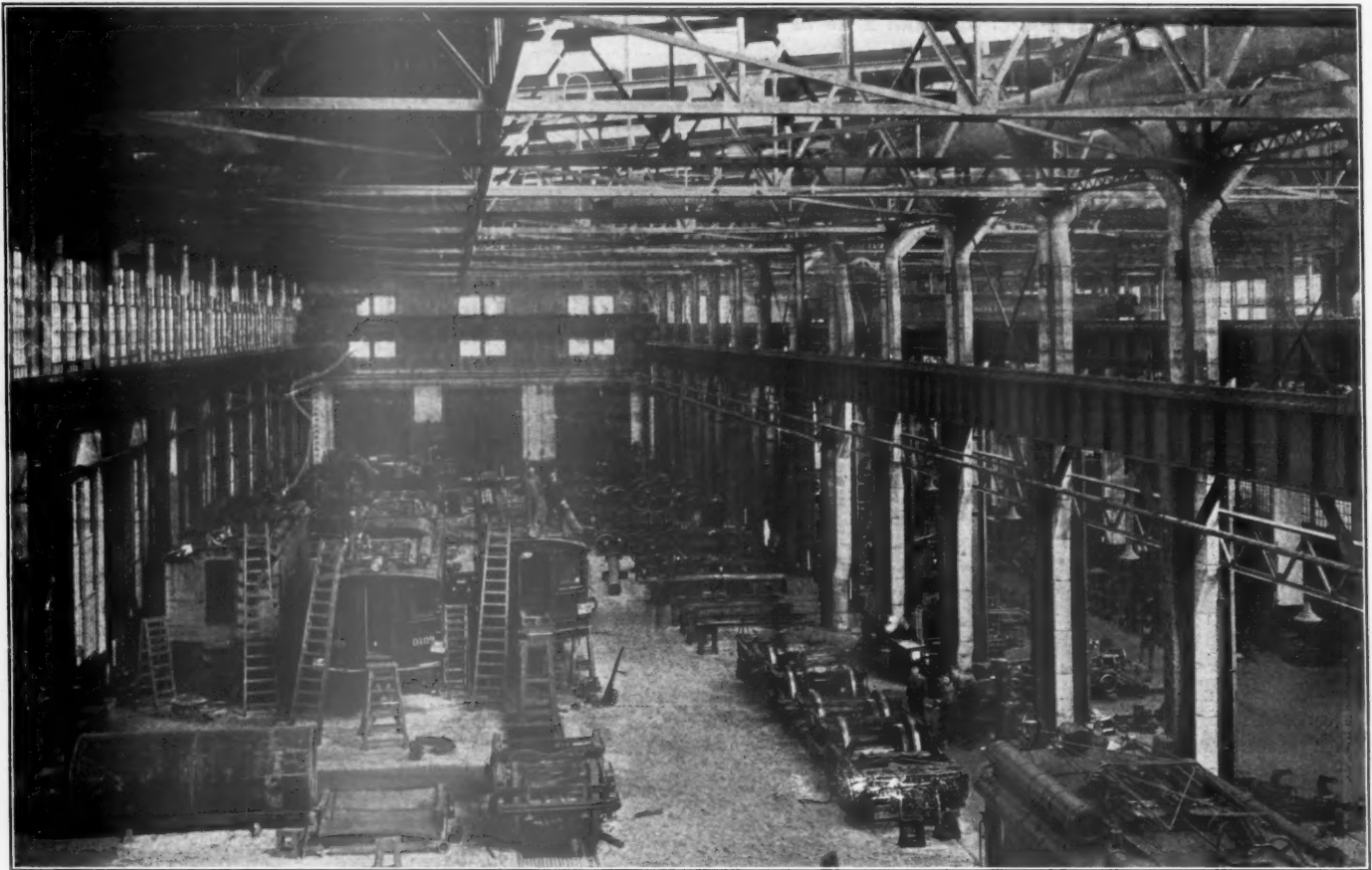


Fig. 2—General View of Erecting Shop for Electrical Equipment

M. C. B. rack shown at the left in Fig. 4 for testing distributing valves.

Another large rack is used for testing pneumatic signal valves, and contains apparatus corresponding to a 10-car passenger train. For testing and adjusting feed valves and reducing valves, special equipment is provided to determine the accuracy of adjustment and sensitiveness of these valves. Compressor governors are adjusted when mounted at the most unfavorable angle for operation, making doubly sure that they will operate when placed upright in the locomotives. On the M. C. B. rack there is an adjustable differential valve used for determining the friction of and testing for leakage around the pistons in the distributing valves or triple valves.

The air brake department tests and repairs equipment sent in from any point on the electrified zone, in addition to that taken from locomotives or cars being overhauled in the shop.

in an hour and forty-five minutes; a freight locomotive with geared motors requires a slightly longer time. Fig. 5 shows the method of removing a passenger locomotive axle with its motor.

Large machine tools include a 96-in. Pond wheel lathe, a 96-in. boring mill, a 60-in. engine lathe, 42-in. wheel lathe, two planers, several other large lathes, a milling machine, boring tools, etc., and a Newton cold saw. Besides the 300-ton armature press before described, there is a 600-ton horizontal wheel press. In the blacksmith shop are a large steam hammer, a forging machine and a double punch and shear for heavy sheet metal.

Two small storage battery motor trucks are used for transportation between the shops, storehouse, lye vat house, blacksmith shop and scrap yard. The varnish tank for dipping armatures and fields is located outside the main shops, to avoid risk of fire. There are two tanks, connected by an

underground pipe with provision for drainage from one tank to the other in case of fire.

Most of the welding and cutting in the shops is done by the oxy-acetylene process. The shop and inspection shed are provided with a piping system, having taps at convenient points, for oxygen and acetylene, for which the feed tanks

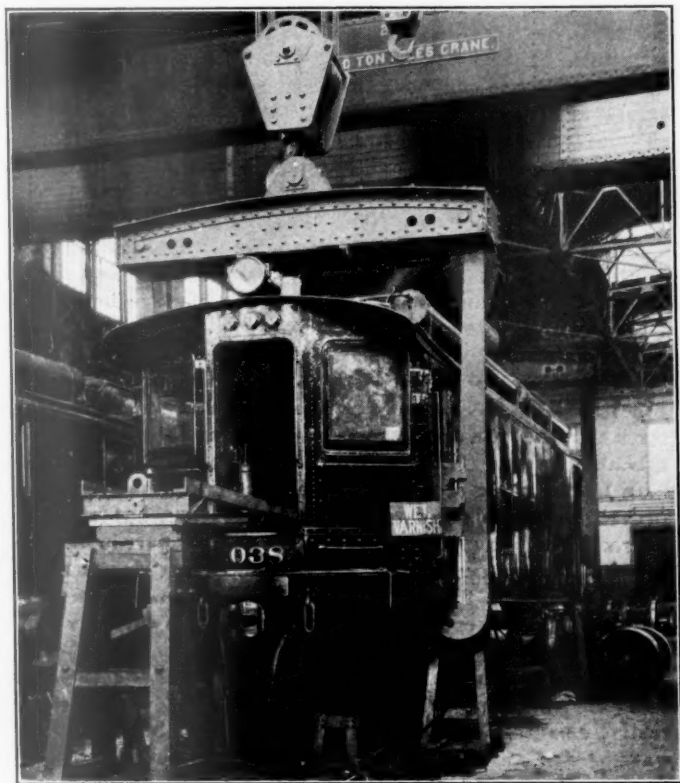


Fig. 3—Crane Hooks for Lifting Locomotive Cab

are located in a separate building. The shop is also wired with special lines for electric welding. Power is supplied from a 400-ampere Ridgway welding generator operating at about 90 volts, driven by an induction motor. Three welding circuits may be operated at once and there is a separate

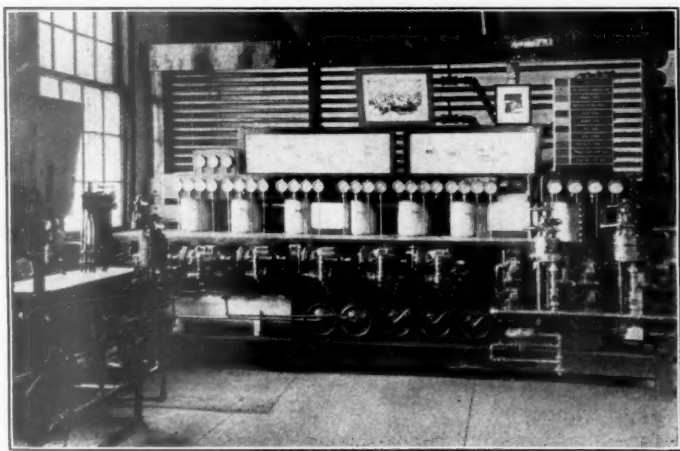


Fig. 4—Air Brake Testing Racks

bank of resistors for each circuit, behind the main switch-board.

#### SHOP ORGANIZATION

A chief inspector, general foreman, and shop specialist report to the superintendent of shops. The chief inspector and his assistants attend to the inspection of all work done

in the shops, including the complete locomotives or motor cars, any equipment removed for repairs, and all parts made in the manufacturing department.

The shop specialist or tool expert has general charge of design and changes of all shop tools, templets, jigs, dies, etc. Interchangeability and efficiency of tools are promoted by having but one man in charge of this work. It is his duty also to suggest improvements and short cuts in the various shop operations.

The general foreman, besides having general charge of the shop, has particular charge of the work on electrical equipment. A foreman of electrical construction looks after all wiring on locomotives and cars, and pays particular attention to overhaul work, while the assistant electrical foreman superintends running repairs made in the inspection shed. An assistant general foreman reports to the general foreman and has charge of mechanical department work. The electric

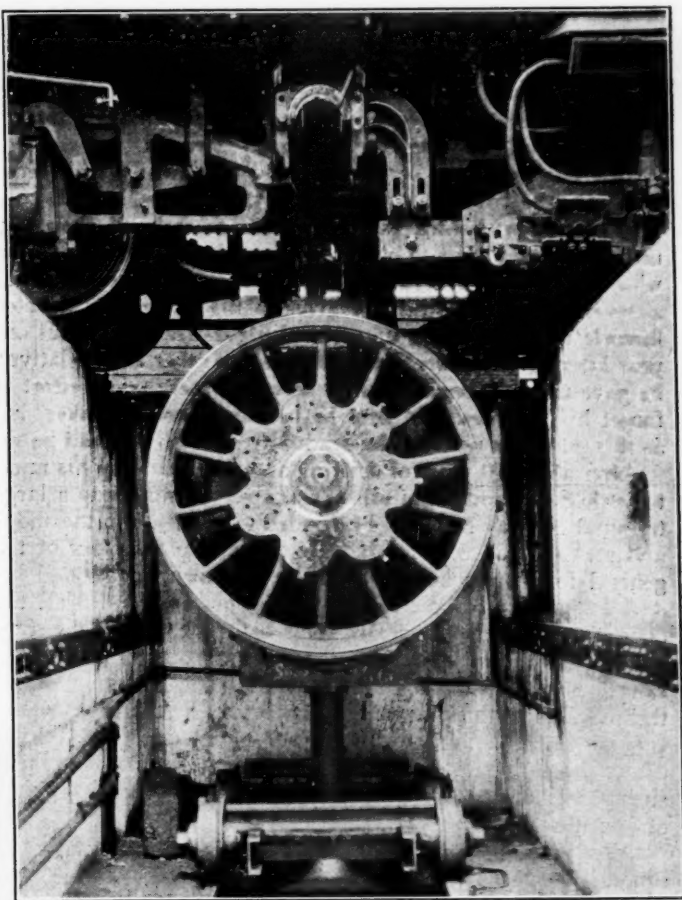


Fig. 5—Dropping an Axle and Motor from a Passenger Locomotive

welding and gas welding work is done under the direction of the pipe fitter leader.

#### APPRENTICES

Two-year and four-year courses are given to men training in the shops. The special apprentice or two-year course is designed for technical graduates, and includes general training in both mechanical and electrical work. These men may also be called on for work at other points or on the road. The regular four-year apprenticeship course at Van Nest includes two general classes, mechanical and electrical; the mechanical is subdivided into blacksmith, sheet metal and tool maker courses, in which the apprentices put in the full time on specialized work, and the general electrical course, in which is included three months' electrical work, machine shop, assembly, erection, etc., in the different parts of the shop. The electrical apprentice is given experience in all

electrical work done in the shop, including armature winding, and in addition spends three months at mechanical work, principally in the machine shop.

## MAKING "STICKERS"

BY HARVEY DE WITT WOLCOMB

Railroad shops have been hit harder than any other class of industrial plants during the past two years, when workmen have been in such great demand for the production of munitions. To make matters worse, the railroads have done a record breaking business, which, in many cases, has compelled them to increase their forces. Under such conditions to lose their best workmen—those mechanics who, because of their skill, are in demand wherever they go—is a very costly experience.

However, with all its handicaps, many good men could be retained in the railroad shop if the foremen would use a little common sense in their methods of dealing with the men.

Bill Mead's experience is by no means an uncommon one. Bill was a typical "boomer" machinist. For ten years he had worked in many shops, generally riding into a town on the "bumpers" and staying only long enough to make a "stake" before moving on wherever his fancy directed.

Bill was the victim of genuine hard luck, which had forced him into the life of a "boomer." At one time he had been a good citizen, holding a job in a large railroad shop, but misfortune had come to him, first through the loss of his wife, who was killed in a runaway accident. Although this was a severe blow, Bill did not give up his home, but devoted himself to the bringing up of his little daughter. About one year later his daughter died. Having no other near relatives, he gave up, and began to drift here and there in an effort to forget his troubles. At first he became a hard drinker, but as this gave him no relief he gradually gave up this bad habit.

After about 10 years of drifting about he made up his mind to settle down and begin all over again. Coming into a large terminal one day last fall, he decided to get a job in the shops and make a man of himself. He hunted up the office of the general foreman, who hired all the workmen, and stated his desire to secure work. He proved by his answers to all the questions asked that he really knew his trade, and as the shop was very much in need of workmen at that time, all the arrangements were quickly made and Bill had a job. After the regular routine had been completed, Bill turned to the general foreman and asked him to recommend, or at least direct him, to a respectable boarding house. He was a stranger in town, and was anxious to secure the right kind of boarding quarters.

"What the h—l do you take me for?" angrily asked the general foreman. "Do you think I am going to give you a job and then take you home to keep, too? I have all the troubles I can tend to right out here in the shop without running all around town looking up boarding houses for every bum who comes along."

Bill finally found a boarding house himself, and proved that he was a first class machinist. However, he didn't stay long, for his first impression had not been very pleasant and he felt an aversion for the shop.

One day he laid off a half day and took a train to a small town about 20 miles away, where there was a large manufacturing plant. On asking for employment at this place, one of the first questions asked him was whether he had as yet secured boarding quarters. The clerk, who was making out his employment papers, spoke to his superior about a boarding place, and you can imagine Bill's surprise when the superintendent of the plant was summoned to take Bill out in his automobile to look at several boarding places. They were gone less than 30 minutes, but Bill had had a chance to study the superintendent and found him to be every inch a man. The first day of the following week Bill started

to work in that factory. He has since been promoted to a foremanship.

Take the case of Tom Jones. Here was a man who had failed in business, and who had been a first class mechanic before he took up a business career. As soon as he lost his business he turned again to his trade as a means of earning a living for his family. As he was too proud to remain in the town where he had failed, he went to a railroad town not far away and applied for work. The shops being short of workmen, he was quickly hired, but when he asked the general foreman about the schools, stores, houses and other similar matters which he wanted to know about for the benefit of his family, he was very much surprised to have the general foreman reply that he was no book of information and would be d—d if he would look up any information like that. With this kind of an answer, Jones picked up his grip and went to the next town, where there was a large manufacturing plant.

Here the superintendent's chief clerk took him out to look at houses, took him out to the high school, where he met and talked with the superintendent of schools—in fact, spent nearly half a day with him. Jones is working in that factory to-day. His value to the plant has been demonstrated several times by labor-saving devices which he has worked out, and for which the management has paid him extra. It now seems probable that the next superintendent of that plant will be a man by the name of Tom Jones—a man who has more than proved his worth to an industrial corporation, but whom the railroad company lost simply through the narrow-mindedness of a man performing a most important function—the hiring of men. If Jones was lost, may not many other good men have been turned away or have drifted away because of the actions of this same foreman?

Go into almost any railroad shop and one will not find the atmosphere of "brotherly love" which should really exist. There is the case of Bill Smith. Smith was a fine workman but had one serious fault. He drank. He was an old timer in the shop and because of his unusual skill had always been taken back after his sprees. Not long ago he applied to the general foreman for an increase of one cent an hour in his wages. He was curtly turned down with the remark that the company was not increasing the wages of "bums." Shortly after this, the superintendent of a large factory in the same town met him and asked him if he would like to try a job in the factory. "What will you pay me?" asked Smith. "Well, I'll tell you just how it is," replied the factory superintendent. "We know that you drink too much; if you take a job with us and continue to drink, you will only be worth 40 cents an hour to us, but if you will cut out the drink you will be worth 70 cents an hour." Smith has "cut out" the drink and apparently his reform is permanent. The railroad has lost a good workman and the factory has gained one.

At another large shop it seemed almost impossible to hold workmen. One incident is sufficient to indicate the reason why this was so. The master mechanic in charge at this point was known as a "horse" for work and insisted that his men must work just as hard as he did. Suddenly during one of the severe cold spells in the winter, his roundhouse foreman laid off, reporting sick. Although this foreman had not missed a day for nearly a year, the master mechanic was very angry when after three days the foreman had not yet returned to work. Just before leaving the shop that night he sent a short note to the foreman's home. The note read: "Get on the job to-morrow, or else get off." The next morning the note was returned by the foreman's wife with these words written across one corner: "Mr. Smith, Master Mechanic: My husband died this morning at 2 o'clock." It is not necessary to comment on the feelings of the foreman's wife. However, if this situation had been handled as it would have been in an industrial plant, the widow would not have added to the difficulty of holding workmen at that point.

by the recital of her husband's treatment in the time of trouble. An industrial plant in the same locality has a regular sick committee which visits every workman on the second day of his absence from work, and when one of the foremen is sick, the superintendent himself makes a personal visit.

Here is another case. A "boomer" mechanic got into some kind of trouble after working hours and was arrested. As soon as this was found out, he was immediately shown out of the service; for it was understood that "crooks" were not wanted. Another factory manager who was anxious to secure workmen heard of the case and interested himself in it. He found out that the workman was in no way to blame for any wrong doing, so he promptly went on his bail and gave him a job. To-day this same "boomer" is a steady workman. Just another case where the railroad overlooked the opportunity to secure a badly needed "sticker."

A master mechanic wanted a certain letter that had been filed for some time. The regular file clerk had resigned to accept a better job elsewhere and none of the office force could locate the desired letter. The master mechanic was heard to remark that when he got another satisfactory file clerk, he wouldn't let the devil himself get that clerk away from him. Shortly after this, he greeted one of his best mechanics, who came into his office, as follows: "Well, what kick have you got now? At the rate you come up here you must wear out a lot of shoes, for you are the most regulator visitor I have."

## MODERN RAILWAY SHOP LIGHTING

An excellent example of adequate lighting facilities of railway shops may be found in the main shop building of the Ferguson, Ky., shops of the Cincinnati, New Orleans & Texas Pacific. This building contains the erecting, boiler, machine, blacksmith and pipe shops. The electric power system is 250 volts direct current. The old lighting system, which consisted of 230-volt direct-current arc lamps suspended from the columns and roof trusses, had proved unsatisfactory from the standpoint of maintenance and efficiency and so was discarded in favor of the high wattage incandescent lamp system. The lamps for the new installation are not connected directly across the 250-volt direct-current lines, but a three-wire balance set is installed to permit the use of 125-volt lamps, as the efficiency and reliability of these lamps are considerably better than that of the 250-volt type.

### ERECTING AND BOILER SHOPS

By referring to Fig. 1, which shows a floor plan of the main building, it will be seen that the erecting and boiler shops are in one continuous bay, 466 ft. long by 78 ft. wide. The bay is 49 ft. high from the floor to the bottom of the roof trusses, and it is served by two traveling cranes the tracks of which are 31 ft. above the floor. The lighting in this bay consists of eleven 1,000-watt lamps (lights B—Fig.

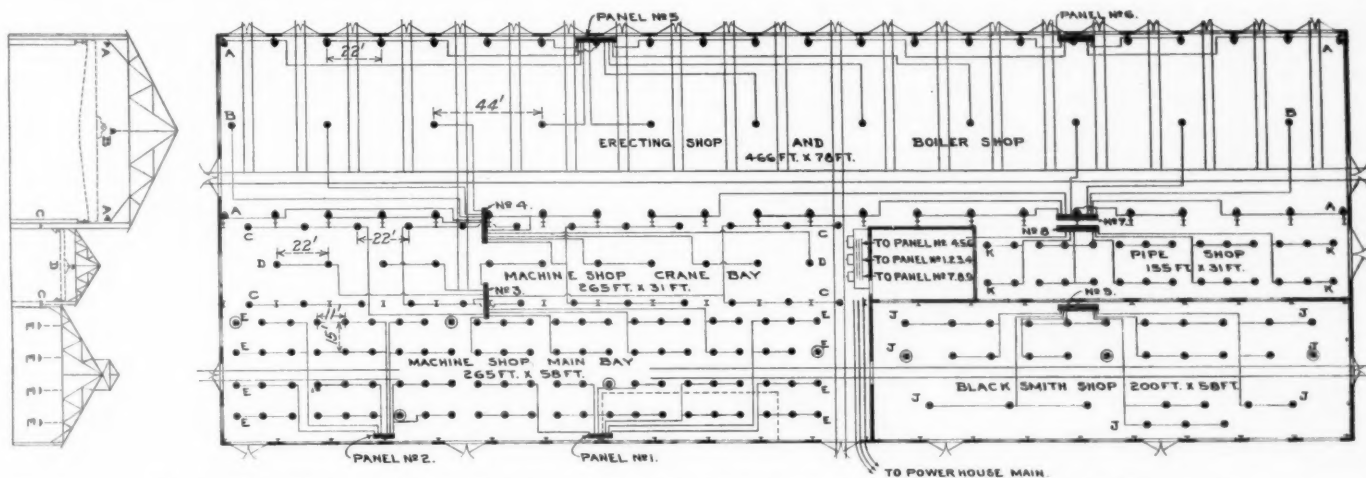


Fig. 1—Floor Plan and Wiring Diagram of the Main Shop of the C., N. O. & T. P. Shops at Ferguson, Ky.

The master mechanic did not know what this man wanted, but as he had asked for a few changes in his working conditions not long before, assumed that he was there again on a similar errand. This time, however, he had come to report an idea for a labor saving device, which he had worked out. After such a reception he took no further action in the matter. Shortly afterward he left the service, and his idea is proving its value in another plant.

The costliness of firing men has been brought out too many times to require any discussion here. But is it not just as costly to let men drift out of the service, or to discourage those entering the service? The slight additional effort required to put the human touch into the relations of the foreman and workmen has been found to pay in industrial establishments and on some railroads. It will pay the others just as well.

**A NEW HEAT INSULATING MATERIAL.**—Prof. R. C. Carpenter, in the Sibley Journal of Engineering for December, 1916, reports the results of tests of balsa wood, Ochroma Lagopus. This wood is of tropical origin, lighter than cork, strong, elastic and a good heat insulator. After being treated, balsa wood has been used for insulating refrigerating compartments of vessels and should be adapted to use in car construction.

1) in deep fluted bowl reflectors, evenly spaced on the center line, 44 ft. apart and suspended from the roof trusses at a mounted height of 41 ft. above the floor. There are also twenty-two 500-watt lamps (lights A—Fig. 1) in elliptical angle reflectors on each side wall, or a total of 44 in the bay. The elliptical reflectors are spaced 22 ft. apart and are set at a mounted height of 40 ft. This height of installation was necessary to avoid the shadows cast by the overhead cranes. With poor reflector conditions, a current consumption of 0.9 watt per sq. ft. gave an average intensity of  $6\frac{1}{2}$  foot-candles on a reference plane 3 ft. from the floor.

The appearance of this shop under night conditions is illustrated by the photograph, Fig. 2. It will be noted that there is a remarkable absence of shadows, which demonstrates the high illumination efficiency of the installation. The proper illumination of such a building presents a most difficult problem because of the deep holes or spaces between the locomotives. The illumination is particularly uniform between the locomotives and around the wheel lathes in the foreground at the right.

### MACHINE SHOP CRANE BAY

As shown in Fig. 1, the machine shop crane bay is 265 ft. long by 31 ft. wide; the distance from the floor to the bot-

tom of the roof trusses is  $26\frac{1}{2}$  ft. and the aisle is served by one traveling crane which operates on a track 20 ft. from the floor.

The lighting installation consists of eleven 500-watt lamps (lights D—Fig. 1) in deep fluted bowl reflectors suspended from the roof trusses on the center line. The units are 22 ft. apart and are suspended to give a mounting height of 25 ft. from the floor. There are in addition twelve 100-watt lamps (lights C—Fig. 1) in flat cone reflectors on each side of the bay, or a total of twenty-four 100-watt units. These reflectors are suspended under the crane track, are evenly spaced 22 ft. apart and are installed to give a mounting height of 12 ft. With approximately one watt per square foot this installation gives an average illumination of seven foot candles. Fig. 3 shows the machine shop crane bay at night with artificial illumination. There is hardly a shadow to be seen and all parts of the shop stand out in clear relief. The photograph shows the location of the various fixtures very clearly, especially those which are suspended from the crane track.

#### MACHINE SHOP MAIN BAY

The machine shop main bay, as shown in Fig. 1, is 265 ft. long and 68 ft. wide, and the distance from the floor to the bottom of the roof truss is 20 ft., or  $6\frac{1}{2}$  ft. lower than the machine shop crane bay just described.

A special condition was met in this shop which necessi-

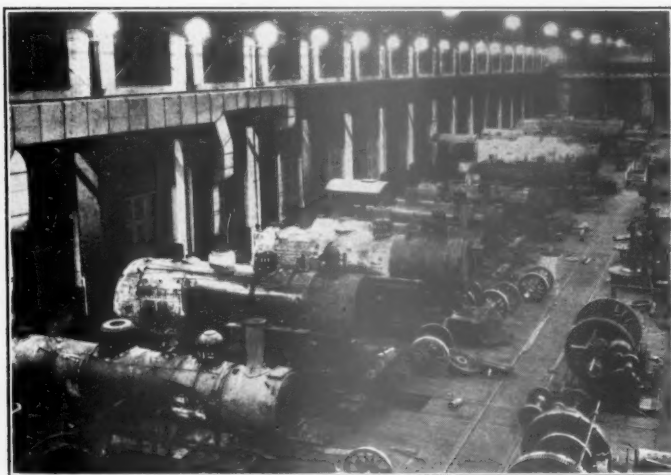


Fig. 2—Night View of Erecting and Boiler Shop

tated a slight departure from the standard scheme of mounting large units as high as possible. The machines in this shop are belt driven from overhead line shafts, so that in order to avoid shadows the lamps were suspended below the line of belting, as shown in Fig. 4. The lighting in this bay consists of ninety-two 100-watt bowl frosted lamps (lights E—Fig. 1) in shallow bowl reflectors arranged in four rows of 23 lamps each. The units are evenly spaced in rectangles 15 ft. by 11 ft. and are suspended from the roof trusses so as to give a mounting height of 11 ft. With 0.6 watt per square foot, this arrangement gives an average illumination of over five foot-candles on a reference plane 3 ft. above the floor.

The arrangement of circuits and lamps is shown in the lower left hand corner of the wiring diagram in Fig. 1. Photographs showing night views of this shop are reproduced in Fig. 4. It should be noted that the main line shafting over the center of the aisle drives counter-shafts for machines on both sides, so that horizontal belts from the center go both ways; the photograph shows that the lighting units are low enough to clear these horizontal belts so that they in no way interfere with the illumination. Bowl frosted lamps were used to minimize the glare which would otherwise be noticeable from fixtures at such a low mounting height.

#### BLACKSMITH SHOP AND PIPE SHOP

The lighting installations in the blacksmith shop and pipe shop in the main building, and the offices and storerooms in the other buildings, follow the same general scheme of overhead illumination which has just been described for the other shops in the main building. The arrangement of circuits and the location of units in both the pipe and blacksmith shops are shown on the wiring diagram in Fig. 1. A daylight



Fig. 3—Machine Shop Crane Bay Under Its Own Illumination—Note the Absence of Shadows

view of the blacksmith shop showing the location and relative height of the lighting fixtures is shown in Fig. 5.

The type of fixture used throughout consists of a porcelain enameled steel reflector with a fitting tapped for direct connection to  $\frac{1}{2}$ -in. rigid conduit, and each fixture is suspended by a standard suspension fitting and arc lamp hook clamped to the overhead conduit system. Such a suspension enables the entire fixture to swing freely in any direction,

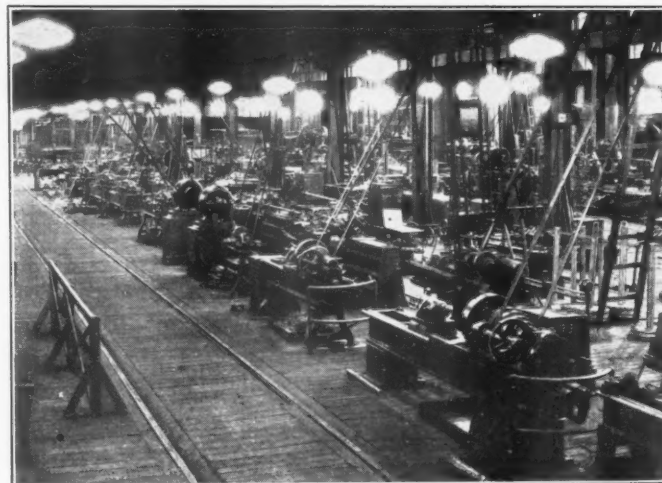


Fig. 4—Night View of the Main Bay of the Machine Shop

which prevents breakage of the stem at the outlet box in case the fixture is struck by a broken belt or handled roughly in cleaning. The entire wiring system is installed in rigid iron conduit and distributing panels are mounted in steel cabinets located at convenient points about the shop.

#### WATCHMAN CIRCUITS

For the convenience of the watchman, and to avoid burning an unnecessary number of lamps when the watchman goes through the buildings or shops, three center lights in the

erecting and boiler shops are provided. They give sufficient illumination and take a minimum amount of current. In the machine shop and blacksmith shop the eight lamps designated on the diagram in Fig. 1 by double circles are on two special watchman circuits, which are entirely separate from the main circuits.

#### FIXTURE CLEANING

Nitrogen-filled tungsten lamps are used throughout the main shop building. Figures showing the cost of maintenance of these units are not yet available as only a few of the larger lamps have required renewal since they were installed eleven months ago. It has been found that the larger reflectors located in the erecting shop, where the mounting is very high, require cleaning only every 60 days, but the other



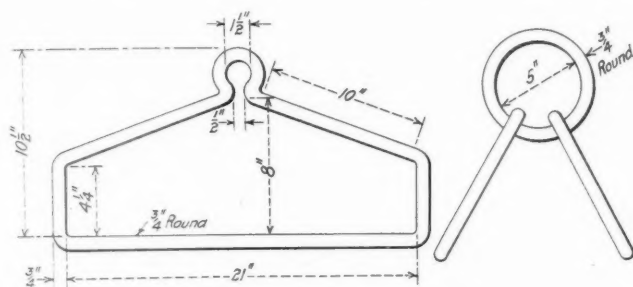
Fig. 5—Blacksmith Shop, Showing the Arrangement of the Lights

reflectors are cleaned every two weeks. In this connection it has been found that where a reflector is subjected to a current of air caused by a belt, the dirt will deposit much more rapidly than in other locations.

In considering the lighting installation in these shops, it is worthy of note that no drop cords whatever are used. Where the general illumination is of sufficient intensity, drop cords and extension lines are not necessary.

#### HOOKS FOR LIFTING DRIVING BOXES

The simple arrangement of links shown in the illustration is used in lifting driving boxes and has proved far superior to the arrangement of chains ordinarily used for that purpose.



Hook for Lifting Driving Boxes

pose. The device when made with the dimensions shown, is adapted to lifting almost any size of driving box ordinarily encountered, but the dimensions can be varied to suit the sizes of driving boxes and crane hooks.

#### RENEWING BOILER TUBES

BY DANIEL CLEARY

As 98 per cent of the boiler failures are caused by tubes leaking, care must be taken when renewing them. With proper workmanship a large percentage of these failures can be reduced. When the tubes are taken out the back and front tube sheets should be straightened, so that only one or two lengths of tubes will be required. The holes should be rolled lightly in the back tube sheet to break the scale around the tube holes, so that with very little filing a clean tube hole will be obtained.

The tube holes should be countersunk on both sides of the back tube sheet with a rosebit countersink. This will permit prossering the tubes without cutting them. The copper ferrules should be prossered lightly in the tube holes. The roller expander should not be used to fix the ferrules in the sheets as this makes the copper hard and it will not fill in the pitted places that are found on the tubes. A good thickness for copper ferrules is .095 decimal gage copper. Ferrules of heavier gage should be kept in stock to be used when some of the tube holes become large and thus permit using one size of swedging for the complete set of tubes.

The tubes should be swedged down to fit in the back tube sheet with a driving fit—say with four or five blows of a light backing hammer. The tubes should be set with 3/16-in. extending outside of the sheet for beading. A mandrel should be used to set the tubes and they should be rolled with a roller expander, good judgment being used not to roll them too hard. If they are rolled by hand, a lever 12 in. long should be used to pull the expander and the lever should slip through the holes in the expander pin. A lever 18 in. to 24 in. long should not be used as the power thus obtained will ruin the tools as well as the tube sheet holes. When the tubes are all rolled they should be belled out for prossering and beading. Care should be taken that the end of the tube left for beading is turned over enough to allow the prosser expander to reach through far enough so that the tube and the copper ferrule will not be cut partly off. When the tubes are belled out and prossered first there will be from 1/8 in. to 5/16 in. left for the bead and it will require three different sized beading tools for a complete set of tubes. One should be all that is necessary.

Experience and tests have shown that when starting at the bottom of the tube sheet to prosser and roll a set of tubes that by the time all but the two or three rows from the top flange are done, the tube holes in the top of the sheet and at the corners will become out-of-round. Similarly if the tubes are prossered and rolled from one side to the other the holes on the far side are sometimes badly out-of-round. This will cause cracked bridges and will always be troublesome. It is a good practice to roll 12 tubes, front and back, on about 12-in. centers to hold the front and back tube sheets in their proper positions. Where this is done no trouble will be had with the length of the tubes provided they have been cut to the proper length. The tubes should be rolled and prossered in a diamond-shaped enclosure first, then the tubes in the bottom and top corners can then be rolled and prossered. A long stroke pneumatic air hammer should not be used on the two rows of tubes next to the flange as it will start cracks in the knuckle of the flange running out from the tube holes. It will also injure patches. If the two outside rows are prossered with a backing hammer there will not be as many cracked tube hole bridges.

To make a first class tube setter, select a young man with intelligence who is honest with his work. He should have experience in rolling 10 or 15 sets of tubes in front ends and should have good practice using the pneumatic air hammers. He should be instructed by a first class tube setter on the first three or four sets of tubes he handles. He will learn more kinks in the few days he is with a good instructor

than he would learn in a year if he were turned loose to do the best he knew how.

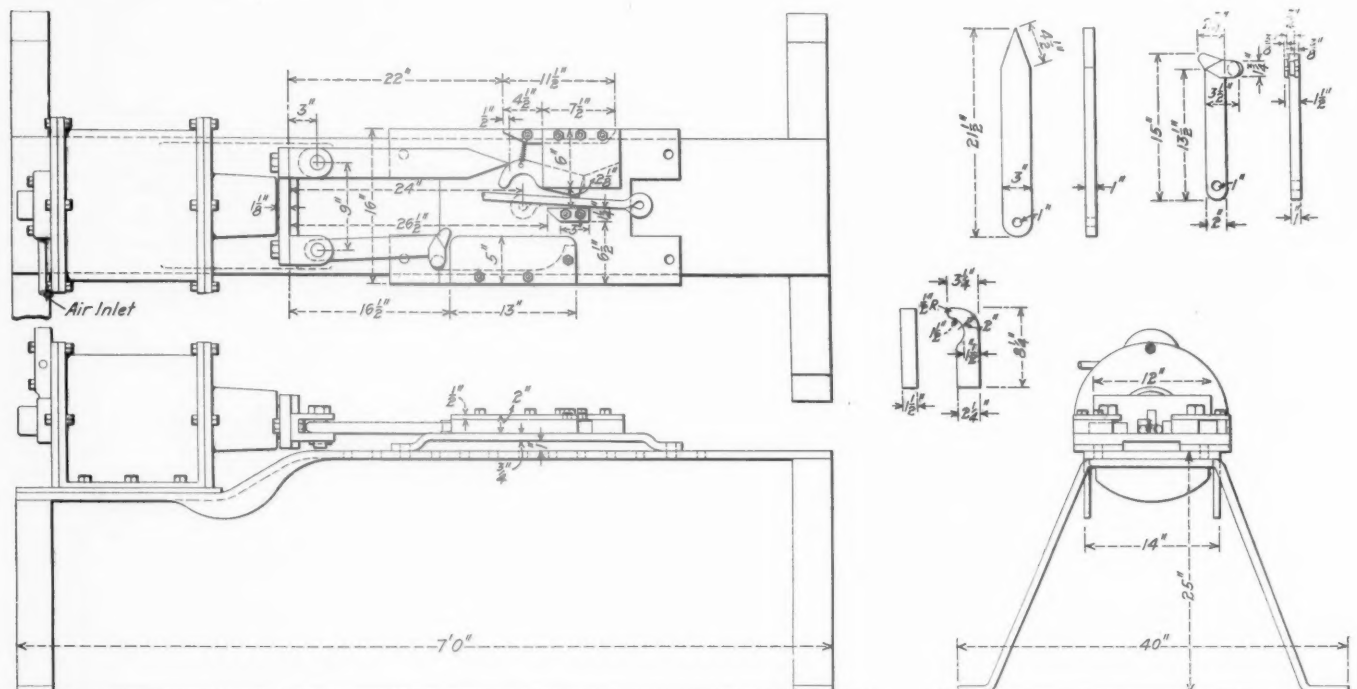
Don't allow the tubes to extend  $\frac{3}{4}$  in. to one inch outside of the front tube sheet. They are hard to roll and shim and are very inconvenient for the machinist when he is putting in the steam pipes. The tubes should extend outside of the front tube sheet for only about  $\frac{1}{4}$  in. and when rolled a quick taper mandrel and pin should be used for all tubes. This will give better holding power to the tube sheet and it

## EYE FORMING MACHINE

BY J. H. CHANCY

Foreman Blacksmith, Georgia Railroad, Augusta, Ga.

The machine shown in the illustration is used for bending eyes on brake hangers of various descriptions, rake handles, etc. It is made from bar iron and can be easily constructed in most any shop. A brake cylinder is used to operate it, the air being taken from the shop line. A crosshead on the end



Machine for Forming Eyes on Rods

will save beading the tubes on the front tube sheet in high pressure boilers.

The prosser is the best tool to use when working old tubes in roundhouses. A tube mandrel can also be used. The calking should be done with a pneumatic hammer. The beading tools should not be allowed to become flat. They should be kept in good condition so that they will keep the bead raised up and compact. A roundhouse which has no pneumatic hammer for beading the tubes should be furnished with two prosser expanders, one for  $\frac{1}{2}$ -in. sheets and one for  $\frac{3}{8}$ -in. sheets as a good many tube sheets become worn and a prosser for  $\frac{3}{8}$ -in. sheets is needed. A number of roundhouses use the tube roller, but where this is used the tubes become weak after a short time and cause failures.

When tubes are removed from a boiler 12 of the tube holes in the front tube sheet should be enlarged to  $2 \frac{5}{16}$  in. in diameter where 2-in. tubes are used. This would enable the roundhouse boiler makers to take out the tubes easily when necessary as tubes which have run for some months have a heavy scale on them. A piece of  $2 \frac{1}{4}$ -in. tube  $1 \frac{1}{8}$  in. long will make a good bushing for the enlarged holes. A stretch piece of 2-in. tube  $1 \frac{1}{8}$  in. long, large enough to go over the 2-in. tube, can also be used.

**MIXTURE OF ACETYLENE AND OXYGEN FOR WELDING.**—Theoretically  $2 \frac{1}{2}$  volumes of oxygen are required for the complete combustion of one volume of acetylene, but in practice the best welding results are obtained with  $1 \frac{1}{2}$  volumes of oxygen to one volume of acetylene. The flame at the burner has in its center a small white cone, at the apex of which the temperature is about 6,000 deg. F., and consists almost entirely of CO, which is being converted at its extremity to CO<sub>2</sub>. —*Institution of Mechanical Engineers.*

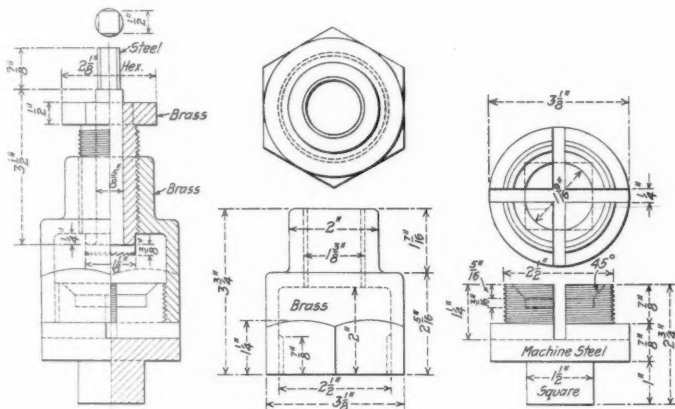
of the brake cylinder piston rod carries two arms, both of which are attached to the crosshead by a single bolt, being free to swing. The upper arm shown in the plan slides between a guide fixed in the frame of the machine and a former which bends the rod in which the eye is to be made, around a pin fixed in the bed of the machine. The lower arm then comes in contact with the rod, completing the bend. This arm slides on a guide fixed to the frame of the machine, which is so formed at the further end as to make this arm close the eye. The machine greatly expedites this class of work.

**ADVANTAGES OF ELECTRIC LOCOMOTIVES.**—In a paper before the New England Railroad Club recently, W. R. Stinemetz of the Westinghouse Electric & Manufacturing Co., enumerated the advantages of electric locomotives as follows: "It eliminates practically all standby losses, the turntable, the delay at water tanks and coaling stations, and its availability for service is much greater, while its maintenance is considerably lower. Its capacity is increased with cold weather, while the reverse is true with the steam engine. Its simplicity of control relieves the crew from many duties necessary on a steam engine, and permits closer observation of track and signals. When properly designed, it is very much easier riding and can have a more uniform distribution of weights with less nosing and track pounding; all of which features tend to lower track maintenance. The one great inherent advantage which the electric locomotive possesses is its ability to concentrate large amounts of horsepower under single control. This locomotive may be in one cab or may be composed of semi-units permanently coupled together. It may have as many motor-driven axles as track structures will permit."

## AIR VALVE FACING MACHINE

In overhauling the valves of air compressors it is difficult to file the tops of the valves exactly square when adjusting for the valve lift. To take each valve to the lathe requires considerable time, so hand work is often resorted to. The inaccuracies resulting from this practice many times result in the valves failing to give satisfactory service. With the device shown in the illustration the work can be done at the bench satisfactorily, thus saving time without sacrificing accuracy.

The valves are held in position in the base of the tool,



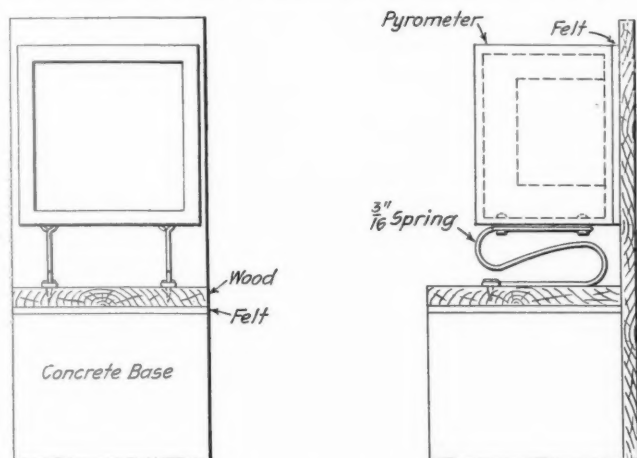
Machine for Facing Air Valves

which is shaped like the seats in the air valve cages. The wings of the valve are held in slots, thus preventing their turning while being faced. The brass cap which fits over the valve carries a disc reamer held in a brass feed screw. By screwing the reamer down against the valves before facing, and measuring the distance between the feed screw and the cap the desired amount can be removed from the valve in one operation.

## SPRING SUPPORT FOR PYROMETER

BY M. K.

Where pyrometers are used in blacksmith shops to determine the heat of the furnaces, it is sometimes difficult to get an accurate reading on account of the vibration caused by working the heavy machines such as steam hammers. Various methods have been tried to overcome this, such as alter-



Support for Pyrometers in the Smith Shop

nate layers of wood and felt, but the only one that has been found to give satisfactory results is the arrangement shown in the illustration. The support for the pyrometer consists of a concrete base covered with a layer of felt and wood to

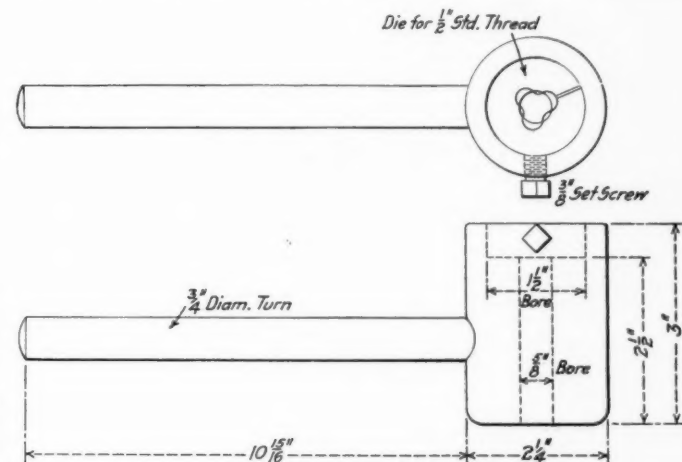
which is attached a spring as shown, which supports the pyrometer. This spring is made of 3-16-in. round spring steel. It is fastened to the wooden base by one lag screw and to the pyrometer by two 1/4-in. bolts. A back rest of wood covered with felt serves as further support for the pyrometer. This arrangement has been found to be entirely satisfactory and there is no quivering of the indicator when the heavy hammers are working.

## TOOLS FOR TURNING AND THREADING SMALL SCREWS

BY W. S. ANDERSON

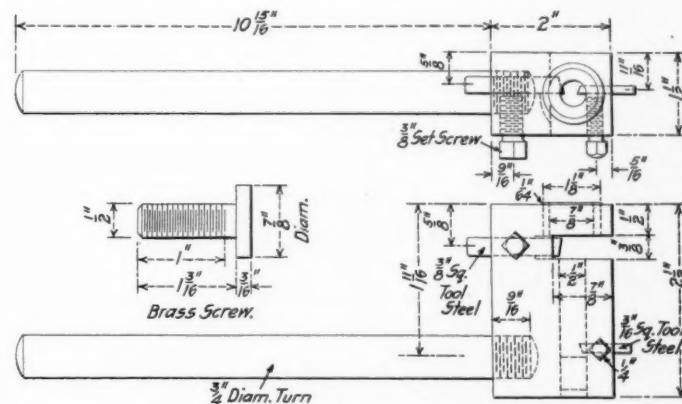
In a shop not equipped with turret lathes, the turning and threading of small screws is a very slow and expensive operation. The drawings show two tool holders which have been developed for making a 1/2-in. brass cap screw.

One of the holders is fitted with two self-hardening steel bits and is used to turn the body of the screw. The dead



Holder for the Threading Die

center of the lathe is made with a 1/2-in. turned extension, just long enough to serve as an accurate guide for the tool holder. The screw is made from a 7/8-in. round brass rod which is chucked in the spindle of the lathe. The turning tool is then placed against the projecting end of the rod and fed forward by the tailstock spindle until the rod has been turned for a length of 1 3/16 in. to a diameter of 1/2 in.



Tool Holder for Turning the Body of the Screw

The turning tool is then removed and the second tool holder, in which the threading die is secured, is placed on the projection of the dead center, the thread being cut in the same manner that the body of the bolt was turned. The screw is then cut from the rod with a parting tool, leaving a head 3/16 in. deep.

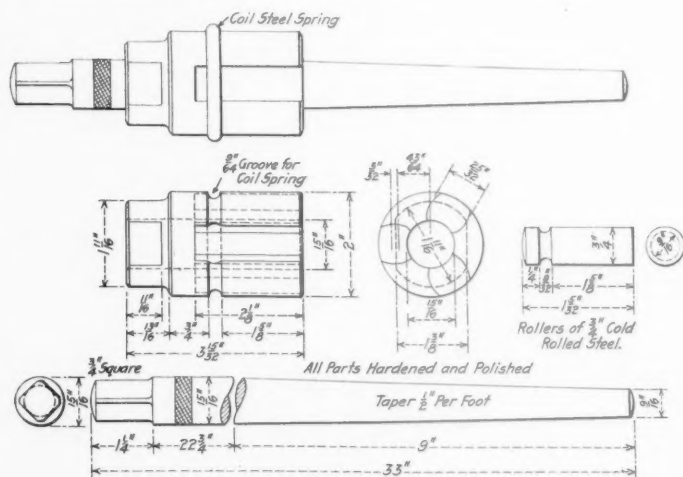
In a shop not equipped with a turret lathe, where screws of

this kind are required, these tools are of great advantage. Where the turning and threading is done in an engine lathe, without the use of such special tools an experienced lathe hand would find it difficult to turn out more than eight or ten in an hour. With these tools a boy is able to turn out about 20 in an hour.

### RECLAIMING AIR COMPRESSOR STUFFING BOXES

BY C. W. SCHANE

It is the general practice on nearly all railroads to scrap air compressor stuffing boxes when the threads are worn slightly small, as a great deal of trouble is caused by the packing nuts working off, unless the box is up to the standard size. By the use of the roller expander illustrated below, the stuffing boxes of either Westinghouse or New York air compressors may be reclaimed if the threads are worn small, but



Expander for Reclaiming Air Compressor Stuffing Boxes

the box is otherwise in good condition. The tool of the dimensions shown in the drawing is used on the stuffing boxes of Westinghouse 9 1/2 in. compressors. It is only necessary to expand the box a slight amount and then rechase the threads with a die nut. The reclaimed parts give as good satisfaction as new ones and a considerable saving is effected by this method.

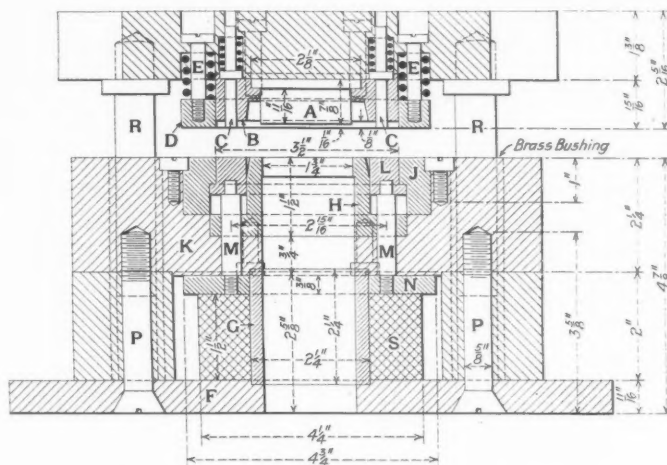
### FORMING STRAINER BRASSES

The die shown in the illustration below has been used for some time for forming feed pipe strainer bases. The parts are punched out and formed in one operation, thus effecting a considerable saving in the cost of production. The inner punch *A* is held in position by the annular punch and former *B*. The outer punch is secured by fillister head screws as shown in the dotted lines. In the center of the lower annular surface of the punch *B* are holes in which are fitted the stripper pins *C*. Outside the punch *B* is placed a stripper ring *D*, which is supported and guided by the fillister head screws *E*. The springs used with the stripper ring should be made of 1/8-in. diameter spring steel to insure forcing the sheet off the punch.

The lower punch is built up on the plate *F*, which carries at its center a bushing *G*. Above this is a block *K*, on which the die *H*, into which the punch *A* works, is set. The die is held down on the block by screws which extend into the base for a short distance. The outer edge of the punch *B* works in connection with the die *J*, which is secured by short fillister head screws sunk flush with the face of the upper block *K*. Between the dies *H* and *J* is a stripper ring *L*, connected by the studs *M*, with the ring *N*, which sets on a

rubber bumper *S*. The lower dies are held together by the screws *P* and the punches and dies are kept in alignment by the pins *R*.

In the operation of the dies the ring *D* clamps the sheet to the lower dies. The circular punch *A* cuts out the center portion, then the outer punch *B* cuts a ring from the sheet. As the dies descend the ring is held in the annular space and



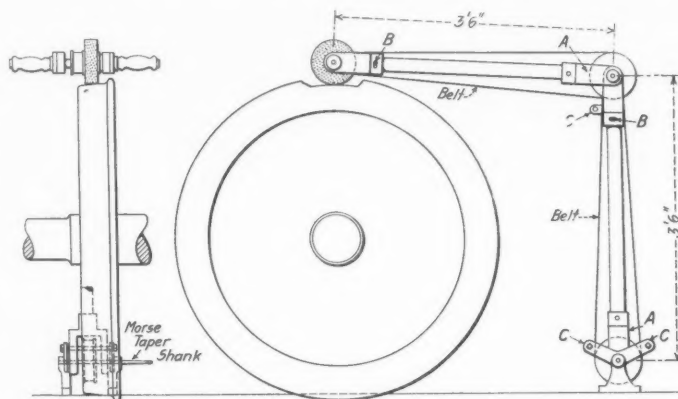
Die for Forming Feed Pipe Strainer Brasses

the inner portion is crimped up between the punch *B* and the die *H*. As the dies separate, the ring *L* raises the finished strainer base until it is flush with the block *K*, and can readily be removed. The stripper pins *C* and the stripper ring *D* force the base and the strip from which it was formed off the punch *B*. Only sufficient clearance for the sheet should be left between the die *B* and the ring *L* when the upper dies are at the lowest point. The strainer bases are formed by this device at a very rapid rate and with no variation in size or form.

### PORTABLE TRUCK WHEEL GRINDER

BY F. OSBOURNE

After building up flat stops on tires by the acetylene welding process, it is necessary to chip and file the weld to fit the tire gage. The weld in most cases is very hard and it takes a great deal of time to chip and file it and also a large number of files are worn out. The sketch shows a portable grinder which is used for this purpose. It is free



Portable Truck Wheel Grinder

to swing up and down on the brackets, *AA*; it can move forward or backward, and it can be turned slightly about both the vertical and horizontal arms by virtue of the slotted holes *BB*. This device is belt driven and power is supplied by air or electric motors. When not in use the arms rest on stops *CC*.

# New Devices

## HEAVY SERVICE PLAIN GRINDING MACHINE

The plain grinding machine shown in the illustration, built by the Brown & Sharpe Manufacturing Company, Providence, R. I., embodies several improvements in design, chief among which is the employment of quick change gear mechanisms in the drive for the work spindle and the table traverse. This gives a smooth, positive drive, and permits the speeds or feeds to be changed quickly. The application of chain drive from the work spindle gear case to the jack shaft and again in the head stock eliminates the slipping of belts when running at the low speeds necessary on work of large diameter. The machines are designed to embody all

the power to the driving plate on the spindle. The pulley *K* drives the change gear mechanism controlling the table traverse when the clutch *P* is engaged. The work spindle and table may be stopped independently of the wheel and the pump by the operation of the lever *L*.

The lever *a* and the index slide *b* control the quick change gears. To obtain the desired speed the lever *a* is dropped, the index slide *b* is moved to the desired speed, as indicated on the plate above it, and the lever *a*, is again raised. A plunger pin in the lever *a* locks the gears in position. The lever *c* controls the fast and slow speed gears and other change gears are operated relative to them.

The quick change gears for the table feed are operated in a similar manner, the lever *f* controlling the fast and slow

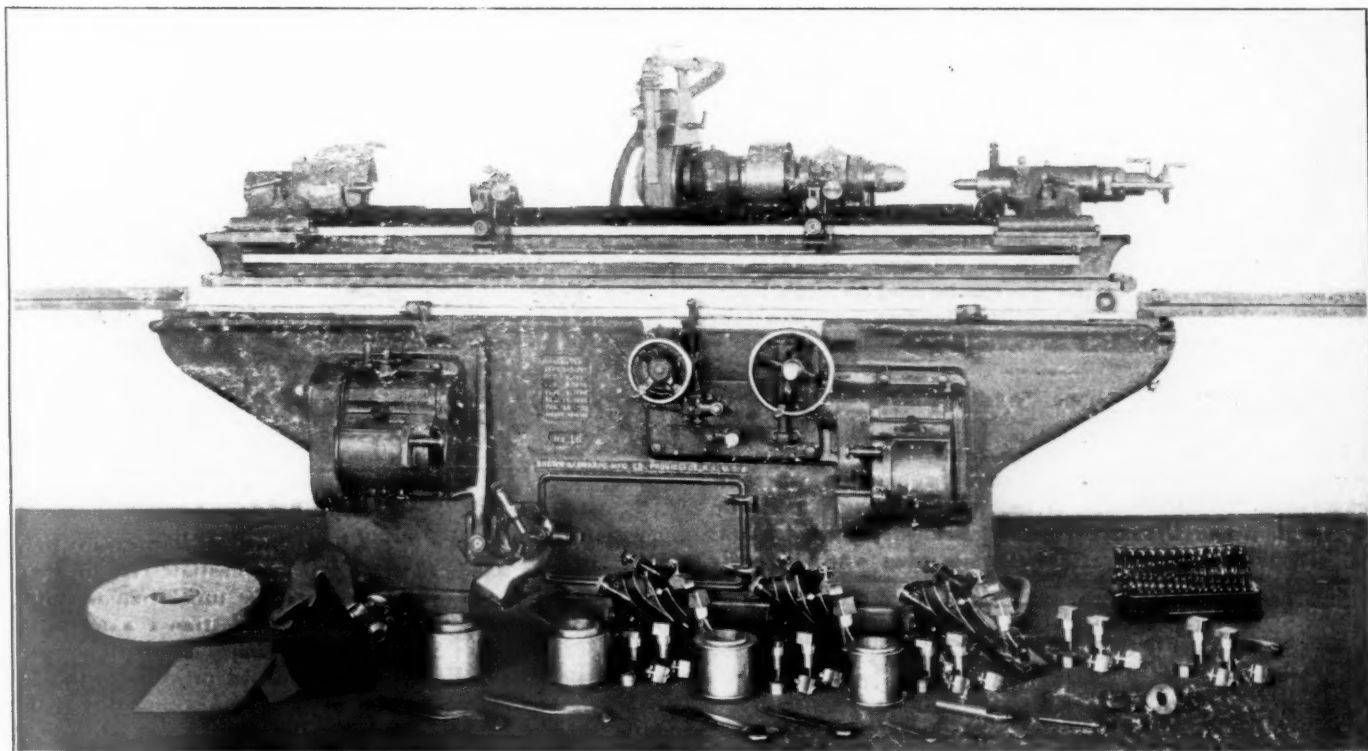


Fig. 1. Plain Grinding Machine for Heavy Work

the features necessary in a plain grinding machine designed for heavy work.

The power is transmitted from the countershaft to the loose pulley *B* (Fig. 2) on the shaft *A*, which runs at a constant speed, operating the work spindle, table traverse, and pump. When the lever *L* is thrown over, causing the clutch *P* to engage with the pulley *B*, the pulley *C* which revolves with the friction clutch *P*, drives the pulley *D* in the change gear case. From the pulley *D* the power is transmitted through the change gears and the chain *G*, to the jack shaft *F* at the rear of the machine, and then to the overhead drum from the pulley *H*. From the overhead drum a belt leads to a pulley on a small jack shaft in the headstock and a reducing sprocket and chain in the ratio of 1 to 3 transmits

speeds, while the lever *d* and the index slide *e* govern the other gear changes. The table may be traversed by hand with the handwheel *g* which can be disengaged when the automatic feed is used. The operation of the reversing mechanism is such that the machine may be used for grinding close to shoulders.

Tapers are ground by swivelling the table on a stud. A scale graduated to indicate the taper in inches per foot, in degrees, and in percent is located at the end of the table to facilitate setting for any taper.

The feed of the wheel is controlled from the front of the machine either by hand or automatically and may be adjusted to give a feed varying from .00025 in. to .004 in. at one or both reversals of the table. The table may be locked

positively against longitudinal feed and the wheel fed in when grinding narrow surfaces. The wheel spindle runs in self-aligning bearings, and is constructed to support a heavy wheel running at a high rate of speed. There are four wheel spindle speeds, varying from 1,000 to 1,700 r. p. m., which are changed without removing the belt by loosening a lock nut and changing a split pulley on the wheel spindle. Water

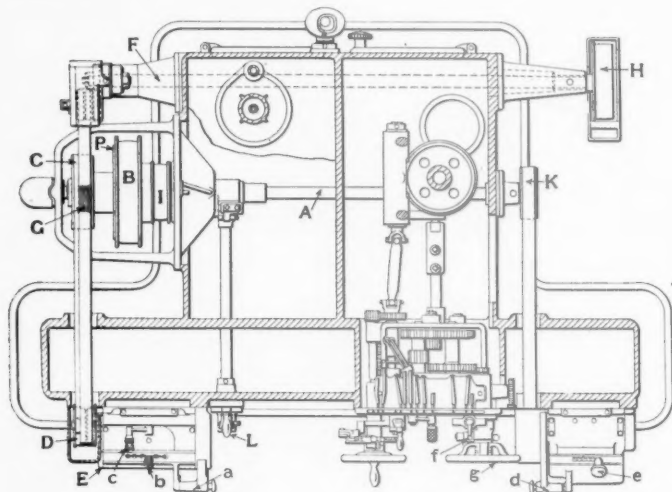


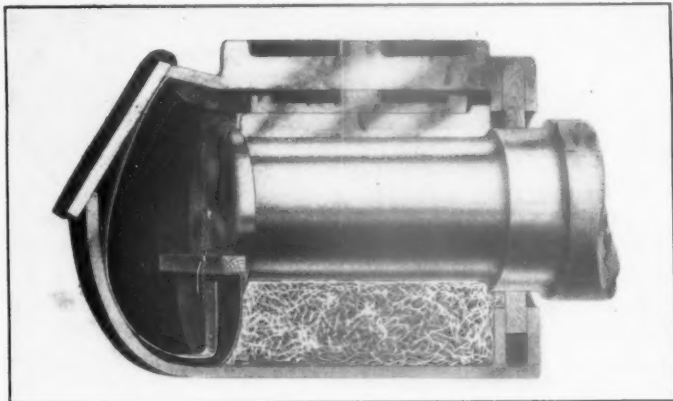
Fig. 2. Sectional Plan of Plain Grinding Machine

is forced to the wheel at the cutting point by the centrifugal pump which, with the tank, is inside the bed of the machine, yet readily accessible. The pump is belted from the pulley *I* on the shaft *A*, and runs at a constant rate of speed, irrespective of the speed of other parts of the machine.

This type of plain grinding machine is manufactured in three sizes, of which the one shown in Fig. 1 is the largest. It will accommodate work 10 in. in diameter and 72 in. in length, while the next smaller size can be used on work 10 in. in diameter and 48 in. long. The smallest size will take work 8 in. in diameter and 36 in. in length.

### JOURNAL BOX WASTE CHECK

The illustration shows a simple and effective device for keeping the waste in journal boxes in position where it belongs on the under side of the journal. It is made by the Ideal Waste Check Company, Box 487, Philadelphia, Pa. By its use the oil saturated waste plug which is ordi-



Journal Box Waste Check

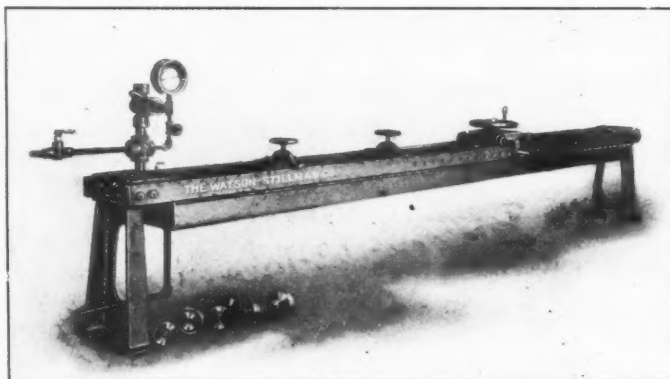
narily used to hold the waste in position underneath the journal, is eliminated and with it a source of hot box troubles. This device is of simple construction, being made of pressed steel with a wooden strip which bears against the end of the axle. Its application does not interfere with

packing the journal box, nor does it have to be removed for inspection of the journal. The waste packing can be adjusted with the waste check in place, and it holds the waste where it is most needed. Where this waste check is used there is less liability of waste being removed from the journal boxes for lighting fires, etc., while cars are on sidings, which is an item to be considered, as where this is done not only is the waste lost, but the journal bearing suffers. With the high cost of waste and oil, the use of this device will save expense as less waste and oil will have to be used. This device has been used on a number of railroads with success.

### BOILER TUBE TESTING MACHINE

A new testing machine for subjecting boiler and other tubing to internal hydrostatic pressure, has been placed on the market recently by the Watson Stillman Company, New York. The machine is designed to be used either with a hand or power driven pump, so that it is adaptable to large and small shops. The machine consists of a frame with two rectangular tie bars, at one end of which is a stationary abutment; at the other end there is a moving abutment in the shape of a carriage mounted on rollers, which can be adjusted to the length of the tubes to be tested and then secured to the side frames by pins. A high pressure hydraulic pump is used to provide the hydraulic pressure.

The tube to be tested is placed in the machine with one end against the fixed abutment, the moving abutment is then brought to bear against the other end of the tube, and is



Boiler Tube Testing Machine

pinned to the frame. The tube is then made pressure tight by turning the hand wheel. Two intermediate clamps operated by small hand wheels prevent the tube from buckling while under pressure. The tube is filled from a water main, overhead tank or by low pressure pump. A high pressure hand or power pump is used to raise the pressure to the desired test, as shown on the gage. A pan is provided under the bed of the machine, to catch the waste water which will serve also as a reservoir if a pump is used for the initial filling.

The machine illustrated is designed to test boiler tubes up to 4 1/4 in. outside diameter to a pressure of 1,200 lb. per sq. in. The minimum opening is 5 ft. and the maximum opening 15 ft. The weight of the machine is 2,000 lb. Other sizes to meet special requirements can be built, using the same general design.

EXPANSION OF STEAM LINES.—Expansion in a steam line

may be found by the rule,  $E = \frac{(L \times 12) \times (T - t)}{150,000}$ , where

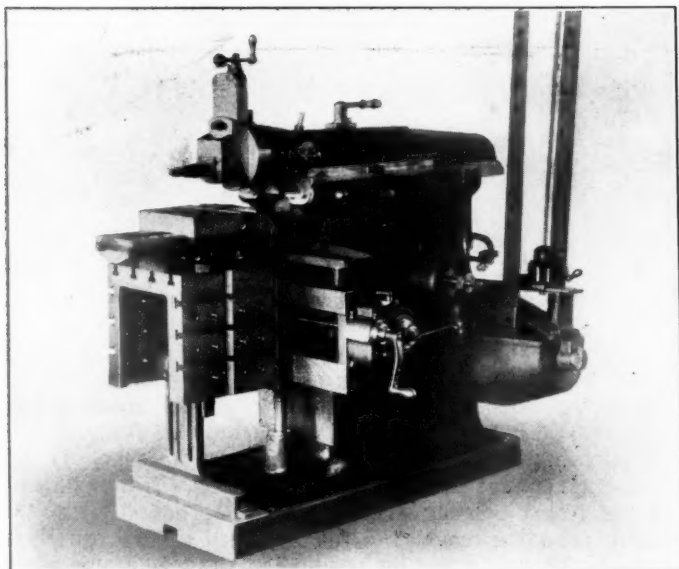
$E$  = the expansion in inches,  $L$  = the length of the line in feet, which is multiplied by 12 to reduce to inches or  $(L \times 12)$ ,  $T$  = the temperature of the pipe when heated,  $t$  = the original temperature of the pipe.—Power.

## TWENTY-INC CRANK SHAPER

A shaping machine which has an actual stroke of  $20\frac{3}{4}$  in. has recently been placed on the market by the Hendey Machine Company, Torrington, Conn. This machine has a speed of ram ranging from 8 to 115 strokes per minute. The table has a top face 16 in. by 20 in. and a side face of  $16\frac{1}{4}$  in. by 15 in., and a horizontal travel of  $24\frac{1}{2}$  in. and a vertical travel of 15 in. The vise is provided with a graduated base and has an opening of 13 in. It is held to the table by four T-bolts. A lug is cast on the under side of the vise to give it additional support when heavy cuts are taken.

The table has an adjustable bottom support which slides on a channel-shaped track so arranged as to protect it from the chips and dirt from the machine, which is liable to throw the table out of alignment. It has a power cross feed giving .008 to .200 in. feed per stroke.

The frame and base of the machine are cast in one piece. An oil pan is provided on the inside of the base, which catches all the drip from the bearings and keeps the floor surrounding



Hendey 20-In. Crank Shaper

the machine clean. The bull gear hub is cast solid with the frame, and it is amply proportioned to withstand all strains arising from heavy cuts. The crank pin and crank pin block are hardened and ground on the wearing surfaces, and the crank pin block is bushed with a cast iron sleeve for the crank pin bearing. The ways for the ram in the frame have an angle of 50 deg. They are planed directly from the solid metal. The gib is combined with the cap in one casting, which makes it rigid, at the same time allowing for adjustment in a horizontal direction. The ram bearing in the frame is  $11\frac{1}{4}$  in. by 34 in. The ram can be set in any position while the machine is in motion or idle, the length of the stroke being shown on the index.

The cross feed mechanism is operated entirely at the end of the cross rail. A dial with an indicator controls the amount of feed, and it can be varied while the machine is in motion. The ball lever at the top of the ram casting throws the feed in or out and in either direction, and may be operated while the machine is in motion. The tool head is bound to the head of the ram by a single screw. It is provided with a micrometer dial reading to thousands of an inch and is provided with a power feed.

The machine may be operated either by belt or motor drive. When belt driven it is provided with a driving cone having four steps. The driving cone shaft has an outboard bearing in the end of the casting, which also forms a guard for the

belt. The machine is thrown in and out of gear by the long horizontal lever shown at the side of the frame, which operates an expanding friction clutch of large diameter. The shaper is back-gear, which with the four steps on the cone gives eight speeds. When motor driven, an adjustable speed motor of about five horsepower running from 400 to 1,200 r.p.m. can be used. The transmission from the motor to the power shaft is by silent chain drive. The machine has a net weight of 4,100 lb. and occupies a floor space of 54 in. by 92 in.

## HORIZONTAL BORING, MILLING AND DRILLING MACHINE

A machine of unusual design for heavy boring, milling and drilling is shown in the photograph. As will be noted in Fig. 1, a motor is mounted on the main column for direct motor drive and is connected to a main driving shaft running vertically in the main column. A boring bar, together with the necessary gearing and control is located in a saddle, and the power is transmitted from the vertical drive shaft or spindle in the saddle through a pair of friction cone clutches, located at the back of the saddle, which makes it accessible for adjustment.

This machine, designed by the Landis Tool Company of Waynesboro, Pa., is equipped with rapid power traverse, independent of regular feeds, that will move the column at right angles to the bed plate and also move the saddle up and down on the column. The feed gearing is all contained in the saddle. Horizontal travel of the boring bar is secured by what is called a concentric screw feed feature. Worm

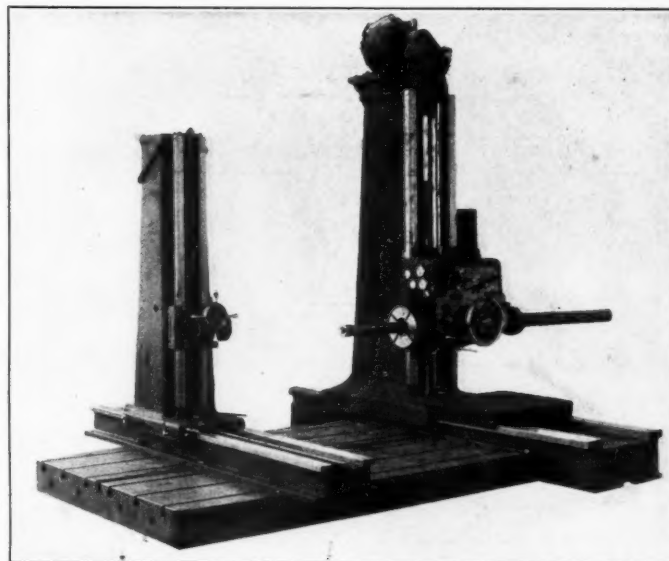


Fig. 1—View Showing Motor Drive on Main Column, Also Independent Column with Sliding Rest

threadways have been cut in the end of the boring bar and there is a clutch with a thread of similar form that can be made to close about and catch on the threaded end of the bar by means of one of the control levers on the outside of the saddle. This feature eliminates the rack and pinion drive with its consequent chattering.

The gear shifts shown in Figs. 2 and 3 are all of the enclosed, sliding transmission type, somewhat similar to the transmission of an automobile. There are 12 changes of speed and 12 changes of feed and a combination of these changes gives a total of 144 actual feed speeds. No two changes of gears can be engaged at the same time, thus eliminating any possibility of stripping the threads. The gears and shifts are made of special heat-treated chrome-nickel steel. The spindle is of high carbon hammered crucible steel.

and ground to secure correct alinement. A syphon oiling system furnishes a continuous supply of oil to the bearings in the saddle. A counterweight for the saddle operates inside of the column and out of the way of the operator.

An independent column is provided with a steady rest

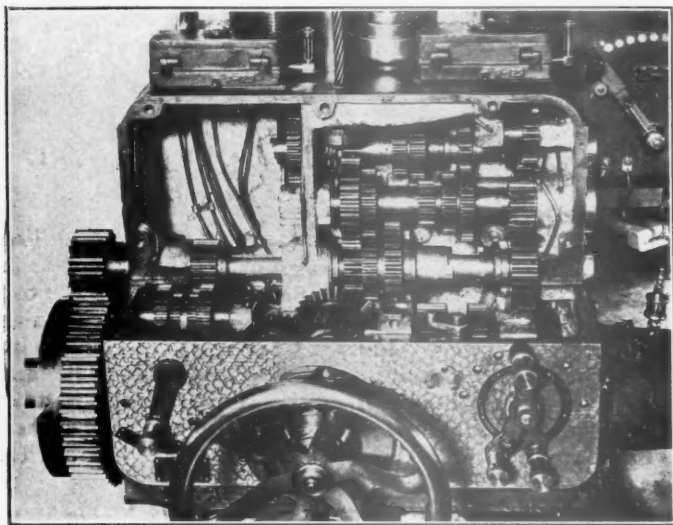


Fig. 2—Part of Gear Box Removed Showing Sliding Transmission

for the boring bar when unusually accurate results or long cuts are desired. An adjustable dial, graduated to thousandths of an inch is provided to be used in connection with the spindle and scales, and verniers also reading to thou-

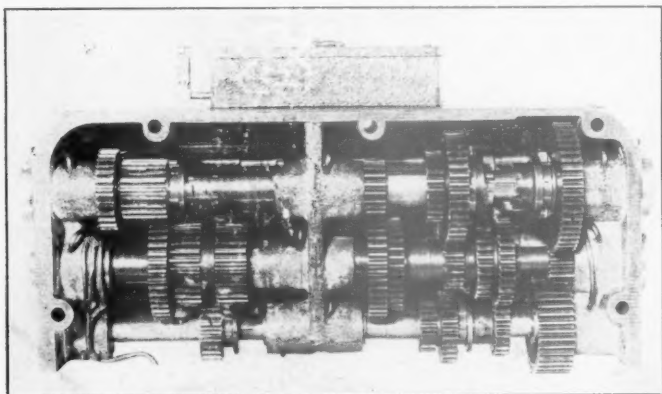


Fig. 3—A Part of the Sliding Transmission That Remains In the Removable Part of the Gear Box

sandths are provided for locating either the main or outer support saddles and columns in desired positions.

This machine will handle a wide range of heavy work and is especially adapted for all classes of milling, drilling and boring in ship yards, navy yards, locomotive shops, etc.

**CARS AND LOCOMOTIVES ORDERED IN MARCH.**—The orders for cars and locomotives in March were rather below the level set for the months immediately preceding. The locomotive purchases in particular fell off. The freight car buying, however, is fairly active, there being several important inquiries for cars now pending. The totals for the month follow:

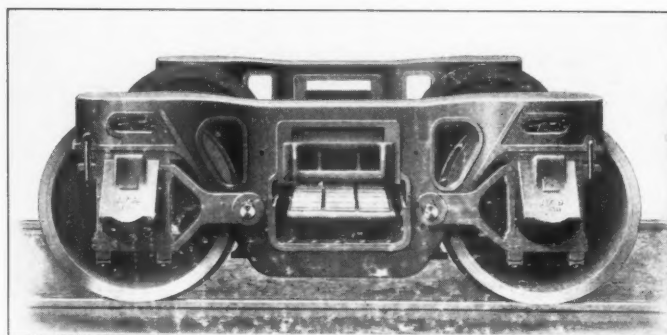
	Locomotives	Freight Cars	Passenger Cars
Domestic .....	298	8,232	572
Foreign .....	4	2,050	...
Total .....	302	10,282	572

The total of 572 passenger cars includes, among other orders, 477 subway cars ordered by the Interborough Rapid Transit Company, 50 cars ordered by the Philadelphia & Reading and 41 ordered by the Southern Pacific.

## ARTICULATED TENDER TRUCKS

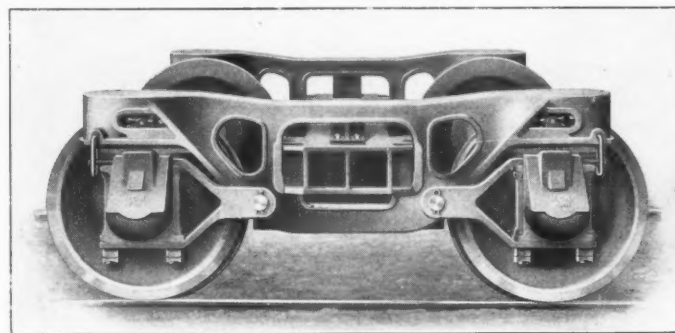
A pedestal truck that has all the advantages of the common pedestal truck and eliminates the wear on the pedestals and journal boxes has been developed recently by the Economy Devices Corporation, 30 Church street, New York City. It also permits the use of the standard M. C. B. journal box. This truck is made in two types; one is designed for passenger and fast freight service and the other for freight and switching service. Both are shown in the illustrations. The journal box and pedestal wear is overcome by pivoting the boxes to the side frame. Triple coil springs placed directly over the journal boxes support the side frames and relieve them from a large amount of shocks to which they are subjected when they rest directly on the box. This design also brings a larger amount of the truck weight on spring supports.

The spring seat for the triple coil springs is a dish



Articulated Truck for Passenger Locomotive Tenders

shaped casting, which is designed to transmit the lateral thrust of the truck to the journal box and thus relieve the pin connection of the journal box yoke from undue strain. This casting has an ample bearing in the side frame and is the part that bears the most wear. A lug with a hole is cast on the upper edge of the spring seat casting. It may be seen in the frame opening above the journal box. When the wheels are to be removed, a rod is passed through this hole to keep the spring seat in position in the side frame when



Articulated Truck for Freight Locomotive Tenders

the frame is being jacked up. To remove the wheels, the frame is lifted until the spring seat is free from the journal box. The journal box yoke pin is removed and the wheels are rolled out. This journal box pin must be removed from the inside, and as an additional safeguard the brake hanger must be moved in order to get the pin out of the frame. Thus, while in service, if for any reason the cotter key which holds the pin becomes lost, the pin cannot work out of its hole. The journal box with the yoke attached is removed from the axle by removing the wedge and brass from the journal box and pulling the parts off in a horizontal direction. In no case is it necessary to remove the journal box from the yoke unless either become broken.

The side frames are made of cast steel in channel sections. The journal box yokes are also of cast steel. The trucks are designed to use either lateral motion or rigid bolsters of standard design. The passenger and fast freight trucks are provided with a triple elliptic spring under the bolster and have a spring plank 22 in. wide by 6 in. deep. The trucks for freight and switching service are of the same design and construction as the passenger truck with the exception of the elliptical springs and the spring plank. In this case the bolster is supported directly on the side frames.

### ROD PACKING AND SWAB HOLDER

The Paxton-Mitchell Company, Omaha, Neb., has made a slight change in its rod making, to insure the spring which holds the packing segments against the rod being applied in the proper manner. As shown in Fig. 1, a recess is formed

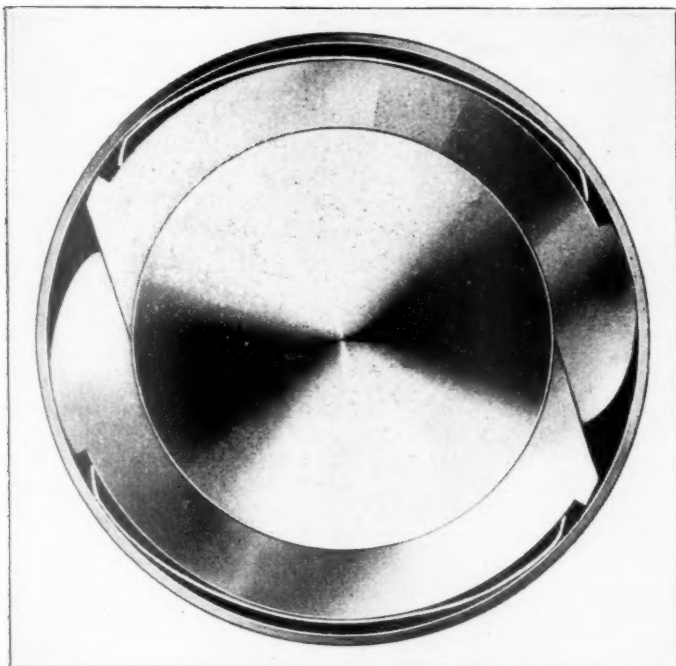


Fig. 1—Improved Type of Paxton-Mitchell Packing

in the outside of the packing segments for the spring, thereby making it impossible to misapply them. The general form of segments has not been changed and they operate the same as before. It is claimed that the segments for superheater

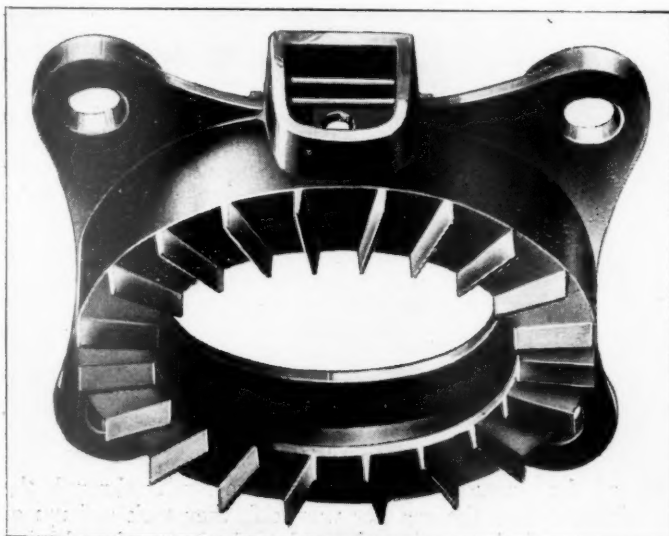


Fig. 2—Swab Holder Designed Especially for Superheater Locomotives

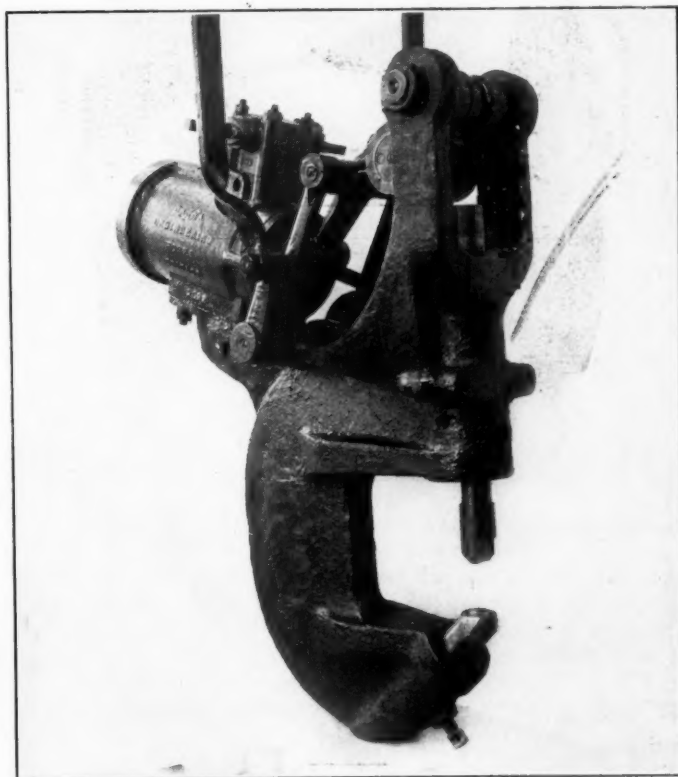
locomotives are made of a material that will stand over 1,000 deg. F., and further, that the wear on the rod is no greater than that with saturated steam packing.

This company has also developed a new air-cooled swab holder that has been found to give especially good service. It is shown in Fig. 2. It is made of brass and was designed primarily for superheater locomotives where the high temperature is liable to destroy the lubricating qualities of the swab. The new holder has fins on the outside face as shown in the illustration, which increases the radiating surface and thus carries away the heat from the swab. Lugs cast on the back of the holder provide a  $\frac{3}{8}$ -in. air space between it and the gland. This also assists in dissipating the heat. With this swab holder on a superheater Mikado locomotive it has been possible to keep the swab in use for two months with satisfactory results.

### HANNA PNEUMATIC RIVETING MACHINE

In the illustration below is shown a new type of Hanna pneumatic riveter sold by the Vulcan Engineering Sales Company, Chicago, which is designed especially for operations where the space for the stationary die is limited. The lower stake or nose is removable and can be shaped to whatever form is best adapted to the work being handled.

The mechanism is of the regulation Hanna type, which



New Type of Hanna Riveter

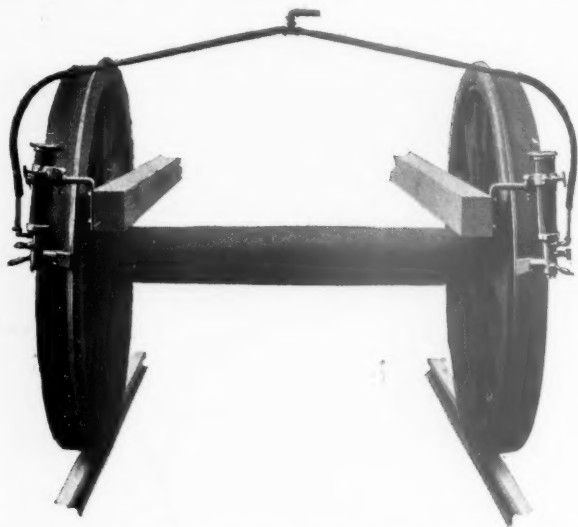
employs a combination of toggle and lever movements of the dies. This has the advantage of permitting a large opening of the dies with a gradual increase in the amount of pressure applied as the dies close until the desired amount is secured, the pressure through the remainder of the stroke remaining practically constant. As the rated maximum pressure is exerted through a relatively large space, the necessity for adjustment to take care of ordinary variations in rivet length, diameter of hole or thickness of plate is done away with after the machine has once been set.

This machine exerts a maximum pressure of 30 tons, and

is adapted to driving  $\frac{3}{4}$ -in. rivets in structural work, or  $\frac{1}{2}$ -in. rivets where steam tight joints are required. It has a 12-in. reach and 12-in. gap, with a die travel of 4 in. The cylinder is  $10\frac{1}{2}$  in. in diameter. The machine is intended to work with an air pressure of 100 lb. per square inch. It is designed to be suspended from a crane and can be balanced so that rivets can be driven at any angle. Various sizes are built to meet the requirements of boiler, tank and structural work.

### SWANSON AUTOMATIC FLANGE LUBRICATOR

A number of railroads in Colorado are now using a flange lubricator which is manufactured by the Swanson Automatic Flange Lubricator Company, Denver, Colo. The illustration shows the method of application. The body of the lubricator is pivoted near the center to allow the feed shoes to follow the lateral movement of the wheels. The reservoir is filled at the end of each run with car oil, and the device will then require no attention over the division. The amount of oil fed is regulated by a plunger in the feed shoe, which is operated by the vibration of the wheel against it. When the engine stops the feed of oil is practically shut off. If



Swanson Flange Lubricator Applied with Heater Pipes

it is desired to stop the flow of oil entirely this can be done by closing a small valve near the outlet. Sediment spaces are provided in the oil passages, and these can readily be cleaned by removing plugs. A heater which utilizes steam from the air pump exhaust is provided on each lubricator. The feed shoe is the only part which is subjected to wear, and it is claimed that the cost of replacement is very low. This device has been applied to engines of various types, and can also be used on cars if desired.

**WAR SCRAP.**—An article in a recent issue of the *Compressed Air Magazine* calls attention in a striking manner to the vast amount of steel which is being consumed in the military operations of the warring European nations. Taking the contested area in front of Verdun, and assuming that an average of a million shells per week were used by each of the opposing armies during the battle, which raged for some 30 weeks, a total of some 60,000,000 shells were thrown. On the basis of an average weight per shell of 100 lb., this means that a total of 3,000,000 tons of steel were thrown upon a disputed area estimated to be about 100 sq. miles, or 64,000 acres. Therefore, an average weight of steel of about 47 tons is somewhere under the surface of each acre of ground, which may have a scrap value as high as \$20 per ton.

### ROLLER LOCK NUT

A new type of lock nut of unique construction has been placed on the market recently. It has a small roller which operates in the annular space on the outer face of the nut, being held in position by a band, as shown in the illustration. This roller acts between the threads on the bolt and against the cam-shaped surface in the annular recess of the nut. It is covered by a tool steel retaining ring, part of which is cut away in the illustration to show the construction of the nut. As this nut is screwed on to the bolt, the roller will ride between the threads, offering no resistance whatever. As the nut turns in the opposite direction, however, the roller will jam in between the threads and the cam in the nut, preventing it from working off the bolt. To remove the nut, a sharp, quick twist is given the nut by an ordinary wrench. This



Roller Lock Nut

forces the roller over into the recess just ahead of the cam. With the roller in this recess, the nut is easily removed. As soon as the nut has been removed from the bolt the roller returns to its original position and the nut is ready for re-application.

The principal advantages of this type of lock nut are that with any vibration or working in service it is free to tighten up, but cannot turn back, and therefore tends to become tighter with recurring vibration. The bolt to which it is applied does not need to be any longer than one used with an ordinary nut without a washer or nut lock. This device has been in test service for a period of over two years. Two railroads have made extensive trials of the nut in track and on rolling stock. Tests are now in effect on the New Haven, the New York Central, the Centrail Railroad of New Jersey, the Pennsylvania, the Lehigh Valley and the Erie. This lock nut is manufactured by the Roller Nut Lock Company, New York.

**KILLED BY CARBON MONOXIDE.**—An instructive case of doing things the way they ought not to be done was that of a boiler maker and his helper at Goulburn, N. S. W. According to a report in the *Australian Mining Standard*, they entered the water tank of a locomotive tender through the manhole, and as the weather was cold, they took a drum of live coals with them. Some hours later both were found lying dead at the bottom of the tank, having been killed by carbon monoxide.—*Power*.

# Railway Mechanical Engineer

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WE GUARANTEE, that of this issue 8,800 copies were printed; that of these 8,800 copies, 7,621 were mailed to regular paid subscribers, 108 were provided for counter and news companies' sales, 535 were mailed to advertisers, exchanges and correspondents, and 536 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 35,972, an average of 8,993 copies a month.

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A large number of men in the shops of the Western Maryland at Hagerstown, Md., struck last week for an increase in pay.

The Lehigh Valley has made an advance of two cents an hour in the pay of machinists, boilermakers and car repairers at Hazleton, Weatherly, Mount Carmel and Delano. The increases are in line with those recently made at Easton and Sayre.

Following conferences with the management lasting several weeks, 1,400 employees of the car repair department of the Chicago & Eastern Illinois were granted an average increase in wages of one and one-half cents an hour. The advance is retroactive from January 1, 1917.

The Pittsburgh Railway Club is taking an active part in helping the Pittsburgh Chapter of the American Red Cross secure an enrollment of 25,000 members. In accordance

with a decision made at the meeting March 26 enrollment blanks have been sent to all the club's members, and they are now busily getting names for the Red Cross. J. Rogers Flannery is chairman of the Pittsburgh Chapter.

The United States Senate on February 13 voted against increasing the postal rates on magazines and newspapers. An amendment to the post office appropriation bill, making the increase, was stricken out of the bill in the debate in the Senate on February 10, on a point of order; and later an effort was made to secure its restoration, under suspension of the rules of the Senate, but the effort failed. This, apparently, settles the matter for the present session.

The shopmen's unions on 20 of the principal western railroads have asked to have their pay increased 10 cents an hour, and to have the workday reduced to eight hours. These unions were granted an increase in pay, following the

negotiations of last autumn, and their day was reduced to nine hours. An officer of the Rock Island lines says that if the new demands are granted, the additional expense on his lines will amount annually to nearly \$3,000,000.

### MEETINGS AND CONVENTIONS

**Tool Foremen's Association.**—The 1917 convention of the Railway Tool Foremen's Association will be held in Chicago, August 30 to September 1, inclusive.

**Car Inspectors' and Car Foremen's Association.**—The 1917 convention of the Chief Interchange Car Inspectors' and Car Foremen's Association will be held in St. Louis, Mo., September 25, 26 and 27.

**The June Mechanical Conventions.**—At the first assignment of space for the Railway Supply Manufacturers' Association exhibit at Atlantic City, June 13 to 20, 70,000 sq. ft. of space was assigned to 200 companies. This amount is already almost as great as the total space used last year. Several new exhibitors have taken space, a large number of regular exhibitors have enlarged their booths and the machine tool builders will have a large representation. There is, therefore, every indication that the exhibit this year will be a record-breaker. Several important improvements have been made on the pier. Machinery Hall Extension has had a ceiling put in it, and the north side of the Annex in front of the cottage has been fitted with glass panels.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations:

**AIR BRAKE ASSOCIATION.**—F. M. Nellis, Room 3014, 165 Broadway, New York City. Convention, May 1-4, 1917, Memphis, Tenn.

**AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.**—O. E. Schlink, 485 W. Fifth St., Peru, Ind.

**AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.**—J. W. Taylor, Karpen Building, Chicago. Convention, June 13-15, 1917, Atlantic City, N. J.

**AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.**—R. D. Fletcher, Belt Railway, Chicago. Convention, August 30, 31 and September 1, 1917, Hotel Sherman, Chicago.

**AMERICAN SOCIETY FOR TESTING MATERIALS.**—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS.**—Calvin W. Rice, 29 W. Thirty-ninth St., New York.

**ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.**—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago.

**CAR FOREMEN'S ASSOCIATION OF CHICAGO.**—Aaron Kline, 841 Lawlor Ave., Chicago. Second Monday in month, except June, July and August, Hotel La Salle, Chicago.

**CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.**—W. R. McMunn, New York Central, Albany, N. Y. Convention, September 25, 26 and 27, 1917, St. Louis, Mo.

**INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.**—A. L. Woodworth, C. & H. & D., Lima, Ohio. Convention, August 21, 1917, Hotel Sherman, Chicago.

**INTERNATIONAL RAILWAY FUEL ASSOCIATION.**—J. G. Crawford, 547 W. Jackson Blvd., Chicago. Convention, May, 1917, Chicago.

**INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.**—William Hall, 1126 W. Broadway, Winona, Minn. Convention, September 4-7, Hotel Sherman, Chicago, Ill.

**MASTER BOILERMAKERS' ASSOCIATION.**—Harry D. Vought, 95 Liberty St., New York. Convention, May 22-25, 1917, Richmond, Va.

**MASTER CAR BUILDERS' ASSOCIATION.**—J. W. Taylor, Karpen Building, Chicago. Convention, June 18-20, 1917, Atlantic City, N. J.

**MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION OF U. S. AND CANADA.**—A. P. Dane, B. & M., Reading, Mass. Convention, September 11, 1917, Hotel La Salle, Chicago.

**NIAGARA FRONTIER CAR MEN'S ASSOCIATION.**—E. N. Frankenberger, 623 Brisbane Building, Buffalo, N. Y. Meetings, third Wednesday in month, New York Telephone Bldg., Buffalo, N. Y.

**RAILWAY STOREKEEPERS' ASSOCIATION.**—J. P. Murphy, Box C, Collinwood, Ohio. Convention, May 21-23, 1917, Chicago, Ill.

**TRAVELING ENGINEERS' ASSOCIATION.**—W. O. Thompson, N. Y. C. R. R., Cleveland, Ohio.

## PERSONAL MENTION

### GENERAL

H. R. PENNINGTON has recently been appointed supervisor of electrical equipment of the Rock Island Lines. His duties in this position will cover the supervision of electrical equipment in shops and roundhouses, locomotive headlights, car lighting and electric and gas welding equipment for the entire system. Mr. Pennington entered railway service on the Frisco Lines at Ft. Smith, Ark., in 1909. He was made division electrician of the Illinois division of the Rock Island Lines with headquarters at Rock Island in July, 1910. He occupied this position until May, 1913, when he was promoted to the position of traveling electrical inspector for the system, the position which he occupied at the time of his appointment above noted.



H. R. Pennington

AMOS WILSON has been appointed supervisor of fuel service of the Delaware, Lackawanna & Western with headquarters at Scranton, Pa., succeeding M. C. M. Hatch, resigned. Mr. Wilson was born in England in 1875, coming to Duryea, Pa., in 1880. After graduating from the public schools he was employed in and around the Lackawanna coal mines, where he learned the trade of mine machinist. In 1899 he became a fireman on the Scranton division of the Delaware, Lackawanna & Western and in 1903 was promoted to engineman on the same division. In February 1913, he was appointed special in-



A. Wilson

### RAILROAD CLUB MEETINGS

Club	Next Meeting	Title of Paper	Author	Secretary	Address
Canadian .....	April 13, 1917	Railway Operating Efficiency as Influenced by Material and Supply Accounts.....	W. Symons.....	James Powell.....	P. O. Box 7, St. Lambert, Que.
Central .....	May 11, 1917	Lubrication of Freight Car Equipment.....	T. J. Burns.....	Harry D. Vought..	95 Liberty St., New York.
Cincinnati .....	May 8, 1917	.....	W. H. Belnap....	H. Boutet.....	101 Carew Bldg., Cincinnati, Ohio.
New England.....	April 10, 1917	High Pressure Steam as Applied for Motor Car Service .....	F. O. Stanley....	Wm. Cade, Jr.....	683 Atlantic Ave., Boston, Mass.
New York .....	April 20, 1917	Railway Water Supply.....	C. R. Knowles...	Harry D. Vought..	95 Liberty St., New York.
Pittsburgh .....	April 27, 1917	Wanted—A Box Car.....	A. M. Schroyer...	J. B. Anderson...	207 Penn Station, Pittsburgh, Pa.
Richmond .....	April 9, 1917	.....	.....	F. O. Robinson...	C. & O. Railway, Richmond, Va.
St. Louis .....	April 13, 1917	.....	.....	B. W. Frauenthal..	Union Station, St. Louis, Mo.
South'n & S'w'rn .....	May 19, 1917	.....	.....	A. J. Merrill.....	Box 1205, Atlanta, Ga.
Western .....	April 16, 1917	Steel Gondolas vs. Composite Gondolas....	Wm. Queenan....	Jos. W. Taylor....	1112 Karpen Bldg., Chicago, Ill.

structor in the motive power and equipment department, also having charge of progressive examinations of firemen, serving in that capacity until his recent appointment as supervisor of fuel service.

T. H. HAMILTON, heretofore master mechanic of the Canadian Pacific, on the Trenton division, Ontario district at Trenton, has been appointed assistant superintendent, with office at Havelock, succeeding E. J. Melrose, transferred.

I. C. HICKS, master mechanic of the Atchison, Topeka & Santa Fe at San Bernardino, Cal., has been appointed mechanical superintendent of the western district of the Eastern lines, at Topeka, Kan.

F. T. HUSTON, general car inspector of the Pennsylvania Lines West of Pittsburgh, at Ft. Wayne, Ind., has been appointed assistant engineer of motive power, with headquarters at Ft. Wayne.

D. P. KELLOGG, superintendent of shops of the Southern Pacific at Los Angeles, Cal., has been appointed superintendent of motive power at Sacramento, succeeding T. W. Younger, resigned.

J. H. MCGOFF, mechanical superintendent of the Eastern lines of the Atchison, Topeka & Santa Fe, at Topeka, Kan., has been transferred to Fort Madison, Iowa, as mechanical superintendent of the eastern half of the Eastern lines, which have been divided into two districts.

#### MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

A. G. ARMSTRONG, master mechanic of the Arizona division of the Atchison, Topeka & Santa Fe, Coast Lines, at Needles, Cal., has been transferred as master mechanic to the Los Angeles division, with headquarters at San Bernardino, succeeding I. C. Hicks, promoted.

W. Y. CHERRY, enginehouse foreman of the Pennsylvania Lines West of Pittsburgh at Allegheny, Pa., has been appointed master mechanic of the Grand Rapids & Indiana, with office at Grand Rapids, Mich.

J. W. CUYLER, master mechanic of the Chicago, Rock Island & Pacific at Armourdale, Kan., has been transferred to Herington, Kan., as master mechanic of the Kansas division, succeeding R. J. McQuade, transferred.

GEORGE L. ERMSTROM has been appointed road foreman of engines on the Yellowstone division of the Northern Pacific, with headquarters at Glendive, Mont.

F. H. HARDIN has been appointed master mechanic of the Adirondack division of the New York Central, with headquarters at Utica, N. Y., succeeding C. F. Deaner, assigned to other duties.

J. J. KARIBO, master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis, with office at Mattoon, Ill., has been appointed master mechanic at Bellefontaine, Ohio, succeeding W. J. Frauendiener, resigned.

L. A. MATTIMORE has been appointed master mechanic of the Arizona division of the Atchison, Topeka & Santa Fe, Coast Lines, with headquarters at Needles, Cal., succeeding A. G. Armstrong, transferred.

D. J. MCCUAIG, general foreman of the Grand Trunk, at Ottawa, Ont., has been appointed acting master mechanic of the Ontario lines, with headquarters at Toronto, succeeding W. G. Sealy, assigned to other duties.

GEORGE MOTH has been appointed division master mechanic of the Canadian Pacific, with office at Edmonton, Alta., succeeding A. E. Dales, transferred.

T. H. ROOMEY has been made fuel supervisor of the Eastern division of the Texas & Pacific, with headquarters at Marshall, Texas.

F. W. RHUARK, master mechanic of the Baltimore & Ohio at Garret, Ind., has been appointed master mechanic at Cleveland, Ohio, succeeding J. F. Gethins.

A. ROESCH, acting master mechanic of the Colorado & Southern, with office at Denver, Colo., has been appointed master mechanic of the Atchison, Topeka & Santa Fe, with the same headquarters, succeeding J. M. Davis.

A. R. RUITER, general foreman of locomotives, Chicago, Rock Island & Pacific, at Chicago, Ill., has been appointed master mechanic of the Kansas City Terminal and St. Louis divisions, with headquarters at Armourdale, Kan., succeeding J. W. Cuyler, transferred.

J. R. STEED has been appointed assistant supervisor of fuel service of the Delaware, Lackawanna & Western, with headquarters at Scranton, Pa.

#### CAR DEPARTMENT

J. M. BORROWDALE, superintendent car department Illinois Central, with headquarters at Chicago, Ill., has resigned, and the office will be abolished temporarily.

#### SHOP AND ENGINEHOUSE

G. HICKEY, heretofore boiler shop foreman of the Grand Trunk at Toronto, Ont., has been appointed general foreman at that point, succeeding E. Logan, resigned.

ARTHUR W. MCLEAN has been appointed general foreman of locomotives of the Chicago, Rock Island & Pacific, at Haileyville, Okla., succeeding Samuel Tolley, resigned.

J. D. MUIR, heretofore locomotive foreman of the Canadian Pacific at Winnipeg, Man., has been appointed general foreman of the locomotive shops, at Vancouver, B. C., succeeding G. H. Reed, superannuated.

A. P. NEFF, general foreman of locomotives of the Southern Pacific at Los Angeles, Cal., has been appointed superintendent of shops at Sacramento, Cal., succeeding O. B. Schoenky, transferred.

#### PURCHASING AND STOREKEEPING

J. A. BEST has been appointed acting purchasing agent of the Atlanta & West Point and the Western Railway of Alabama, with headquarters at Augusta, Ga., succeeding Robert T. Pace, relieved to devote his time to other duties.

E. LANGHAM, purchasing agent, of the Canadian Northern for the lines west of Port Arthur at Winnipeg, Man., has been appointed general purchasing agent for the system with office at Toronto, Ont. His former position, and that of purchasing agent for the eastern lines have been abolished.

ROBERT T. PACE, has been relieved of his duties as purchasing agent of the Atlanta & West Point and the Western Railway of Alabama, at his own request.

W. J. STURCESS, heretofore storekeeper of the Grand Trunk Pacific at Transcona, Man., has been appointed acting assistant purchasing agent at Winnipeg, Man., succeeding A. H. Mulcahey, transferred temporarily to the Imperial Munitions Board.

#### OBITUARY

CHARLES B. ACKER, general car foreman of the Pittsburg, Shawmut & Northern, died at his home in St. Marys, Pa., on February 21, 1917.

J. F. KEEGAN, superintendent of motive power of the Grand Rapids & Indiana, at Grand Rapids, Mich., died on March 9.

W. C. WALZ, division master mechanic of the Chicago, Burlington & Quincy at Hannibal, Mo., died at that place on March 23.

## SUPPLY TRADE NOTES

J. N. Hansen has been elected president of the Middletown Car Company, succeeding Arthur King, deceased.

F. L. Gordon has been elected assistant to the vice-president of the American Brake Shoe & Foundry Company, with headquarters at Chicago.

Luman R. Dewey has been appointed western sales manager of the American Brake Shoe & Foundry Company, with headquarters at Chicago.

The Titanium Alloy Manufacturing Company has moved its New York office from 15 Wall street to the City Investing building, 165 Broadway.

Arthur King, president of the Middletown Car Company, died at his home at Middletown, Pa., on January 31 of heart disease. He was 75 years old.

S. S. Shields, formerly general road foreman of the Atlantic Coast Line, has been appointed mechanical expert of the Galena Signal Oil Company.

The Mott Sand Blast Manufacturing Company, Inc., of New York, will occupy its new plant in the borough of Brooklyn, N. Y., about April 1.

The McCord Manufacturing Company of Detroit will move its New York office from 50 Church street to room 1416 at 165 Broadway, about April 15.

Marburg Brothers, Inc., manufacturers of several railway specialties, will remove its New York office from 1790 Broadway to 90 West street, on April 1.

William C. Dodd, president of the National Lock Washer Company, Newark, N. J., died suddenly at his home in East Orange, N. J., on Monday morning, March 12, 1917. He was 46 years old. Mr. Dodd had been connected with the National Lock Washer Company since 1886. He was secretary and treasurer of the company for many years and succeeded his father as president of the company upon the death of Mr. Dodd, senior, 12 years ago.

Henderson Weir, secretary of the Harlan & Hollingsworth Corporation, Wilmington, Del., died suddenly Sunday, March 4. Mr. Henderson had been connected with this company for about 21 years, during the major part of which period he acted as manager of the car department, looking particularly after the sales end of the business.

The Q & C Company, New York, has opened a branch office in St. Louis, Mo., No. 1942 Railway Exchange building, under the direction of John L. Terry.

After March 15 the Louisville branch of the H. W. Johns-Manville Company will be located in a new building at the corner of Fourth avenue and Guthrie street.

M. B. Meyers, assistant to the vice-president of the

American Manganese Steel Company, has been appointed sales manager, with headquarters at Chicago, Ill.

W. H. Wood has severed his connection with the Baltimore & Ohio, to enter the employ of the Combustion Engineering Corporation as engineer of tests and research.

L. P. Alford has resigned as editor of the American Machinist to open an office as consulting engineer, and has been succeeded by John H. Van Deventer, managing editor.

William Leighton, formerly with the O'Malley-Beare Valve Company, Chicago, has resigned to take a position with the Oxweld Railroad Service Co., Railway Exchange building, Chicago.

Harlow A. Varney has been appointed manager of the railroad department of the Paige & Jones Chemical Company, of New York City, with headquarters at Chicago.

Mr. Varney was born at Spencer, Ia., September 9, 1887. After leaving high school at Spencer he attended the Iowa State College at Ames, Ia. He began his career in the railway supply field with the Julian L. Yale Company in 1907, leaving this concern in 1910 to enter the employ of the National Boiler Washing Company as general sales manager. After five years with this latter company he was appointed manager of the railroad department for the Smith-Totman Company, later becoming secretary and treasurer of the company. He now becomes manager of the railroad department for Paige & Jones Company, his territory covering the United States and Canada.



H. A. Varney

The Burdett Oxygen Company will complete the erection of its Salt Lake City, Utah, plant on March 1. The capacity of the Los Angeles, Calif., plant has also recently been increased 50 per cent.

James McNaughton, who recently resigned from the vice-presidency of the American Locomotive Company, has been appointed assistant to the president of the Eddystone Ammunition Corporation.

The Independent Pneumatic Tool Company, Chicago, Ill., held its annual sales convention on February 28, and March 1. The first day's meeting was held at the company's factory at Aurora, Ill.

Alexander P. Robinson, formerly vice-president and treasurer of the Cambria Steel Company, died at his home in New York on February 16 from hardening of the arteries, aged 53 years.

Frank N. Grigg, of Richmond, Va., several years representative of the Harlan & Hollingsworth Corporation in southern territory, has been elected secretary of the corporation, succeeding Henderson Weir, deceased.

F. Lloyd Mark, who for the past year has operated a sales engineering business in Chicago, Ill., has been appointed western sales manager of the Stroh Steel-Hardening Process Company, with headquarters in the same city.

E. P. Dillon, formerly assistant to manager of the railway and lighting department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, has been



W. C. Dodd

appointed manager of the power division of the New York office.

William T. Thompson, superintendent of the car department of the Harlan & Hollingsworth Corporation, has been made manager of the car department. Mr. Thompson has been connected with the company for many years.

The Jerome-Edwards Metallic Packing Company, Chicago, on March 1, 1917, discontinued its offices in the Railway Exchange building. Its general offices are now located at the factory, 320-328 North May street, Chicago.

W. S. Rugg, formerly district manager of the New York office of the Westinghouse Electric & Manufacturing Company, has been appointed manager of the railway department, with headquarters at East Pittsburgh, succeeding Charles S. Cook. Mr. Rugg was born at Broadhead, Wis., and is a graduate of Cornell University. His connection with the Westinghouse company dates back to the early days when the company had its plant at Garrison Alley in Pittsburgh. He was later transferred to the Chicago office, and in 1901 was again transferred to the New York office as a special engineer. In 1909 he be-



W. S. Rugg

came district manager of the New York office, which position he has held until this time. Mr. Rugg has been prominently identified with the work of the American Institute of Electrical Engineers, serving for a time as one of its managers.

Cyrus H. Loutrel, factory manager of the National Lock Washer Company, Newark, N. J., for the past six years, has been elected president of the company, to succeed the late William C. Dodd, who died suddenly March 12.

C. E. White has recently been appointed Chicago branch manager of the U. S. Light & Heat Corporation, Niagara Falls, N. Y. Mr. White has for several years past been manager of the Detroit Battery Company of Detroit.

H. A. Waldron, of the selling force of the H. W. Johns-Manville Company's general railroad department, at Chicago, has resigned to become sales manager of the New York office of the Stromberg Motor Devices Company.

Robert L. Arms, for several years connected with the sales department of Manning, Maxwell & Moore, has become associated with the Sherritt & Stoer Company, Inc., 603-604 Finance building, Philadelphia, as assistant to the general manager.

At a recent meeting of the stockholders of Harrison Brothers & Co., Inc., of Philadelphia, the stockholders agreed to accept an offer made by the Du Pont Company of Wilmington, Del., and the paint firm has become one of the Du Pont's subsidiaries.

Ernest H. Weigman, formerly general supervisor of master car builders' billing on the Atlantic Coast Line, with headquarters at Wilmington, N. C., has been appointed assistant secretary of the Master Car Builders' Association, with office in the Karpen building, Chicago.

L. E. Hassman has been appointed representative in

southern territory for Brown & Co., Inc., of Pittsburgh, Pa., with headquarters at New Orleans. Mr. Hassman since February, 1912, has represented the railroad department of the H. W. Johns-Manville Company in New Orleans.

The De Laval Steam Turbine Company, Trenton, New Jersey, announces the opening of a district sales office in the Smith Building at Seattle, Washington, in charge of William Pullen. In addition to steam turbines, the company's products include helical reduction gears as well as pumps and compressors of the centrifugal type.

J. L. Bacon has been appointed mechanical representative of the Economy Devices Corporation in charge of eastern territory, with headquarters in New York. For the previous five years Mr. Bacon was employed in the mechanical department of the New York Central, and leaves that company to take up his new duties.

Blake C. Hooper, district sales manager of the O'Malley-Bear Valve Company, Chicago, Ill., has resigned to become the head of a department, which the Paul J. Kalman Company, St. Paul, Minn., has created to represent the Oxweld Railroad Service Company, the Boss Nut Company and the National Car Equipment Company.

Chas. P. Williams, who has been appointed western representative at Chicago, for the railroad department of the West Disinfecting Company, graduated from the Minneapolis, Minn., high school in 1893 and immediately entered railway service with the Chicago, Milwaukee & St. Paul as an apprentice in the locomotive department at West Milwaukee, Wis. He entered the railway supply business as sales engineer and eastern agent of the Chicago Railway Equipment Company, with headquarters at New York City about eight years ago. He was special representative at Chicago for the National Lock Washer Company at the time his present appointment became effective.

Paul Judson Myler, whose election as president of the Canadian Westinghouse Company, Ltd., of Hamilton, Ontario, Canada, was announced last month, was born in Pittsburgh, April 24, 1869.



P. J. Myler

He was educated in the public schools of Pittsburgh, graduating from the Pittsburgh Central High School. He began his business career as bookkeeper in a Pittsburgh produce commission house. In 1886 he entered the employ of the Westinghouse Air Brake Company as bill clerk in its Allegheny shops, and advanced rapidly through the several bookkeeping and auditing positions of the company. In 1896 he was appointed secretary of the Westinghouse Manufacturing Company, a corporation then being organized with a capital of \$500,000 to do a general manufacturing business in Canada, at Hamilton, Ontario. In 1897 he was made secretary-treasurer. In 1903 the company was reorganized as the Canadian Westinghouse Company, Ltd., capital \$5,000,000, to take over the Westinghouse Electric & Manufacturing Company's electric business and the air brake business of the Westinghouse Manufacturing Company. Mr. Myler was made vice-president and general manager in full charge of the Westinghouse interests in Canada. Mr. Myler is also a director in a number of other financial and manufacturing companies.

## THE NATIONAL RAILWAY APPLIANCE COMPANY

In the March *Railway Mechanical Engineer* announcement was made of the incorporation of the National Railway Appliance Company for the purpose of selling railway supplies, and to take over the entire railroad department business of the United States Metal & Manufacturing Company of New York. The new company has temporary offices at 165 Broadway, New York City, but it will move about April 1 to new offices on the eighteenth floor of the building at 50 East Forty-second street, New York.

The company's officers are as follows: President, B. A. Hegeman, Jr.; first vice-president, Charles C. Castle; vice-president and treasurer, Harold A. Hegeman; assistant to president, F. C. Dunham; secretary and engineer, Edward D. Hillman. The company, as noted previously, has established a branch office in the McCormick building, Chicago, under the immediate management of Walter H. Evans, and a branch office in the Munsey building, Washington, D. C., under the management of J. Turner Martyn. Both managers were formerly connected with the railroad department of the United States Metal & Manufacturing Company.

Mr. B. A. Hegeman, Jr., president of the new company, was formerly in the railroad business. He started in 1878 with the Delaware, Lackawanna & Western, and was at one time general manager of the Lackawanna Live Stock Transportation Company. He left that position to go into the railway supply field as eastern sales agent of the American Car & Foundry Company, and in 1901 he was selected as the president of the United States Metal & Manufacturing Company, which position he has occupied for the past 16 years. Mr. Hegeman is also vice-president of the New York & North Shore Traction Company, vice-president of the Damascus

Brake Beam Company of Cleveland, and president of the Anglo-American Varnish Company of Newark, N. J. In 1914 he was president of the Railway Supply Manufacturers' Association.

Charles C. Castle, first vice-president of the company, has been in the supply business for a long time. He was for many years vice-president of the Hildreth Varnish Company, and became associated with the United States Metal & Manufacturing Company in 1910 as manager of the railroad department. He is vice-president of the Anglo-American Varnish Company of Newark, and secretary and treasurer of the Genesco

Corporation of Rochester, and was president of the American Electric Railway Manufacturers' Association in 1911.

Harold A. Hegeman, vice-president and treasurer of the company, has also been connected with the United States Metal & Manufacturing Company for the past nine years as salesman, and is well known throughout the New England territory and New York state among steam and electric railway officials.

F. C. Dunham, assistant to the president, has been with the United States Metal & Manufacturing Company for the past 13 years as special sales agent, and during that period he has made a wide acquaintance among railroad officials through the promotion of the sales of the Dunham hopper door device.

Edward D. Hillman, secretary and engineer, graduated from Lehigh University in 1898, with the degree of mechanical engineer. He was connected with several manufacturing concerns as engineer during the next four years, entering the employ of the New York Central in February, 1902. From 1902 to 1905 he was in the motive power and rolling stock department of the New York Central, going to the electrical department in December, 1905, where he remained until February, 1906, when he entered the employ of the United States Metal & Manufacturing Company as mechanical engineer.

Albert Clark Stebbins, a vice-president of the Niles-Bement-Pond Company, New York, died February 28 at his home in Plainfield, N. J., at the age of 73 years. He was born in Monson, Mass., and in the year 1865 he became an apprentice in the machine shop of Lucius W. Pond, Worcester, Mass. He remained with that company during its existence and with the organization of the Niles-Bement-Pond Company he was elected vice-president and manager of the Pond Works.



B. A. Hegeman, Jr.



F. C. Dunham



C. C. Castle



E. D. Hillman



H. A. Hegeman

J. Leonard Replogle, who, with his associates, recently purchased control of the Wharton Steel Company, has been elected chairman of the board. Other officials are: H. S. Endsley, president and treasurer; I. Townsend Burden, vice-president; Ernest Hillman, vice-president; H. C. Wenner, secretary, and F. B. Dutton, general superintendent.

#### HUNT-SPILLER MANUFACTURING CORPORATION

J. G. Platt, sales manager of the Hunt-Spiller Manufacturing Corporation, Boston, Mass., and Frank M. Weymouth, assistant to president, have been elected vice-presidents of the company. Mr. Platt has been sales manager of the Hunt-Spiller Manufacturing Corporation, Boston, Mass., since June 1, 1912. He was born at Zanesville, Ohio, February 11, 1874. His parents moved to Baltimore in 1879, and he was educated in the public schools of that city. He entered railway service when he was not quite 15 years of age as a messenger for the Baltimore & Ohio. In January, 1890, he became an apprentice in the locomotive department of the same road, later entering the drafting room as a locomotive draftsman in 1894. On February 1, 1901, he was transferred to Newark, Ohio, as chief draftsman of the Lines West, but on December 20, 1902, he left the Baltimore & Ohio to accept the position of assistant to the master mechanic of the Erie at Jersey City, N. J. He was transferred to Meadville, Pa., April, 1903, as engineer of tests. On February 1, 1907, he left railway service and became master mechanic of the Franklin branch of the American Steel Foundries, with which company he remained until June 1 of the same year, when he accepted a position with the Hunt-Spiller Manufacturing Corporation as mechanical representative, later becoming sales manager, as noted above.

Mr. Weymouth was born in Boston, January, 1873, and was educated in the public schools of that city, after which time, until 1913, he held various positions in manufacturing industries. In February, 1913, he accepted the position of assistant to the president of the Hunt-Spiller Manufacturing Corporation, and will continue in that capacity, in addition to being vice-president.

E. D. Kilburn, manager of the power department of the New York office of the Westinghouse Electric & Manufacturing Company, has been appointed district manager of

this office, to succeed W. S. Rugg. Mr. Kilburn is a graduate of Cornell University. Immediately after leaving college he became identified with the Westinghouse Electric & Manufacturing Company at East Pittsburgh.

A. H. Ackerman, formerly vice-president and general manager of the United States Light & Heat Corporation, Niagara Falls, N. Y., and C. C. Bradford, formerly sales manager of the same company, announce the formation of the Bradford-Ackerman Corporation, with offices in the Forty-Second Street Building, New York, to represent various manufacturers of railway and electrical supplies for domestic and export trade.

The Dodge Manufacturing Company, Mishawaka, Ind., announces the acquisition of properties and products of the Oneida Steel Pulley Company and the Keystone Steel Pulley Company of Oneida, N. Y. The Dodge Steel Pulley Corporation was formed to control the two Oneida companies and will be a subsidiary of the Dodge Manufacturing Company. The sale and distribution of products of the corporation will be under the supervision of the Dodge Sales & Engineering Company, Mishawaka, Ind.

The Vanadium-Alloys Steel Company, of Pittsburgh and Latrobe, Pa., announces that arrangements have been completed whereby the following firms will represent the company in the sale of its high speed steel and its alloy and carbon tool steel: E. T. Ward's Sons, Boston, Mass.; George Nash Company, New York and Chicago; Field & Co., Inc., Philadelphia. A large stock of high speed steel in the most generally called for sizes will be carried at the various warehouses. These stocks are in addition to the stock carried by the Vanadium-Alloys Steel Company at its mill at Latrobe and its Pittsburgh warehouse.

The McGraw Publishing Company, Inc., and the Hill Publishing Company of New York have consolidated as the McGraw-Hill Publishing Company, Inc. The new company acquires all the properties and interests of the two constituents, including the Electrical World, Electrical Merchandising, Electrical Railway Journal, The Contractor, Metallurgical and Chemical Engineering, American Machinist, Power, Engineering News, Engineering Record, Engineering and Mining Journal, and Coal Age. The Engineering News and the Engineering Record will be consolidated as the Engineering News-Record, with Charles Whiting Baker as editor. The officers of the new company are: James H. McGraw, president; Arthur J. Baldwin, vice-president and treasurer; E. J. Mehren, vice-president and general manager. It is said that by the consolidation the new company will be the largest engineering publishing house in the world.

Frederick E. Reed, founder of two of the units of the present Reed-Prentice Company, Worcester, Mass., died at his home in Thompson, Conn., Feb. 18, after a short illness from paralytic shock. Mr. Reed, who was nearly 70 years old, had been active in machine-tool building from 17. He was first employed as a bookkeeper for the Wood & Light Machine Company, Worcester, in which his father, John Reed, had an interest. Later he became chief draftsman for the same company. In 1875 he bought the interest of Vernon Prentice in the firm of A. F. Prentice & Co., and in 1877 became sole owner of the business which, as the F. E. Reed Company, became one of the best known manufacturers of lathes. In after years he organized the Reed-Curtis Machine Screw Company and the Reed Foundry Company. He retired from active business in 1912, when all three of the enterprises in which he had been most prominent were absorbed into the Reed-Prentice Company. Mr. Reed was also heavily interested financially in other Worcester industries, notably the Mathews Manufacturing Company and the Worcester Lawn Mower Company.



J. G. Platt



F. M. Weymouth

## CATALOGUES

**VALVES.**—The Mesta Machine Company, Pittsburgh, in Bulletin D describes and illustrates the Mesta automatic plate valves (Iversen patent).

**POWER HAMMERS.**—Beaudry & Co., Inc., Boston, Mass., have recently issued a 20-page booklet 6 in. by 9 in. in size, illustrating and describing the line of Beaudry hammers.

**TUBE EXPANDERS.**—Catalogue No. 11, recently issued by A. L. Henderer's Sons, Wilmington, Del., describes and illustrates that company's line of expanders, punches, pumps and jacks.

**BELT FASTENERS.**—The Crescent Belt Fastener Company, New York, describes and illustrates its devices in a pamphlet entitled "A Little Selling Talk." Crescent belt fasteners are adapted to use with all kinds of belting.

**TAPS AND DIES.**—Bulletin No. 1, recently issued by the Greenfield Tap & Die Corporation, Greenfield, Mass., is entitled "How to Measure Screw Threads," and describes the G T D thread limit gage, which the company is making for this purpose.

**HIGH SPEED STEEL.**—The Vanadium-Alloys Steel Company, Pittsburgh, has issued a folder descriptive of Vasco-Marvel, a semi-high speed steel. The folder contains much information of interest, together with the high speed steel standard classification of extras adopted July 22, 1915.

**GUN-CRETE.**—The Cement Gun Construction Company, Chicago, has issued a 16-page booklet, covering the composition of Gun-Crete, its application and the advantages of its use. The booklet is illustrated with photographs, showing its use in structures for rust and fire protection, in dams for waterproofing and in repairs to old and defective structures of all descriptions.

**ROOF VENT AND LEADER CONNECTIONS.**—The Barrett Company, New York, has issued a 20-page booklet describing the "Holt" roof connections. It contains descriptions of five types of roof connections, with illustrations and detailed drawings of each device. It also contains a drainage table, showing the size of leader outlets required for roof areas and for different slopes and roofing materials.

**PORTABLE TOOLS.**—H. B. Underwood & Co., Philadelphia, have recently issued a catalogue covering their extensive line of portable tools. The catalogue not only shows illustrations of new tools, but also covers many new and interesting features which have been added to the older types. The booklet contains much useful information, and is of especial interest at this time because of the rapid development which has recently taken place in the design of portable tools, and also because of their increased use in railway shops during the last few years.

**CONDENSER CLEANERS.**—Bulletin 0-2, recently issued by the Lagonda Manufacturing Company, Springfield, Ohio, contains complete descriptions of air, steam and electric driven cleaners for cleaning the small tubes of condensers, heaters, evaporators and similar apparatus. Graphic illustrations show the existing relationship between the vacuum and steam consumption. The bulletin is illustrated with views of Lagonda condenser cleaners at work in different types of condensers, in power plants and ice plants. A special cleaner for evaporator tubes is also described.

**COCHRANE HEATERS.**—The Harrison Safety Boiler Works, Philadelphia, has just issued catalogue No. 710, a 100-page booklet relating to the company's Cochrane heaters for steam

power plants. The book takes up open feed-water heaters for atmospheric service; heaters and receivers for use with exhaust steam heating systems; valve-stack heaters (combined heater, separator and valve); metering heaters for determining boiler capacity and efficiency, and heaters for use with water softeners. It is well illustrated with pictures showing the details of the heaters and the heaters in actual operation.

**LONG LIFE FOR WOOD AT LOW COST.**—The Barrett Company, New York, has recently issued a 14-page booklet with the sub-title "Where and How to Use Barrett Carbosota Grade 1, Liquid Creosote Oil." The booklet is illustrated with views, showing decay in various structures where untreated wood was used in contact with the ground or with concrete, brick or masonry. Two pages are devoted to a description and a detail plan of a simple and inexpensive wood treating plant, and several pages to the various uses and application of creosote oil, together with the directions for using.

**GRINDING WHEELS.**—The Star Corundum Wheel Company, Detroit, Mich., has issued Catalogue No. 9, describing the various types of grinding wheels made by that company and showing the various grinding machines for which they are adapted. The catalogue contains 98 pages, is well illustrated, and gives the list price of the various sizes and types of grinding wheels. It also contains information regarding vitrified, silicate and elastic grinding wheels, together with the uses to which these wheels should be put. Other information is given concerning the general safety requirements in handling grinding wheels, the proper grinding wheel speeds for the various sizes, the method of mounting and other information of interest to those handling grinding wheels.

**WOOD BLOCKS.**—The Barber Asphalt Company of Philadelphia recently issued an 18-page booklet describing its Non-X-Ude wood blocks, and illustrating their use in various kinds of service. Four pages are devoted to specifications covering the kind and grade of wood used, the size and treatment of blocks, the preservative used, the inspection at the works and the laying of the blocks. Several pages are devoted to telling why the blocks do not bleed, why they are durable and why they are used in various places. The booklet contains a table showing the weights of the different size blocks under treatment varying from 12 to 20 lbs. per cu. ft., and a comparative table compiled by the United States Forest Products Laboratory showing the average absorption of oil in lb. per cu. ft., the per cent of bleeding and the per cent of increase from swelling of blocks treated with water gas as compared with other treatments.

**HIGH SPEED STEEL.**—Catalogue No. 33, recently issued by the Midvale Steel Company, gives very complete information relative to the company's alloy and tool steel. The book is in five sections, dealing respectively with the following subjects: I, Midvale carbon tool steels, special alloy tool steels, high speed steels and Steelite. II, Midvale tool steel specialties, steels for hot work, miscellaneous steels, machinery steels, etc. III, Midvale alloy steels. IV, Forged shear blades, forged die blocks, steel rolls, etc., and forgings. V, Tables and useful information, and curves showing critical temperatures and physical properties. Under the various sections information is given as to the characteristics of the steel, its working, the grade numbers and uses of the various temper grades, the list of brands and the purposes for which each brand is best adapted, and the list of extras, etc. The booklet contains 144 pages, and has an 18-page index. The Midvale Steel Company has also recently issued a separate booklet giving information as to Midvale high speed tool steels. This booklet has 22 pages and a number of illustrations of machines on which high speed steel is being used.